



הנהלת בתי המשפט  
ADMINISTRATION OF COURTS

Office Of the Legal Adviser  
Legal Assistance to Foreign Countries

לשכת היועץ המשפטי  
המחלקה לסיוע למדינות זרות

Date: 22/05/14

File: 1-252/14

John Pierceall, Attorney  
Ancillary Legal Corporation  
74 Goldrush Circle  
Atlanta, GA 30328  
USA  
Dear Sir/Madam,

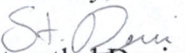
Subject: Request for Service of Documents

Your request for service of documents upon **Coolvision Ltd.** has been executed.

Please find attached the certificate.

Please forward the attached documents to the proper authorities

Sincerely,

  
Sternthal Daniel

Legal Assistance to Foreign Countries

*Reverse of the request*  
CERTIFICATE

The undersigned authority has the honor to certify, in conformity with Article 6 of the Convention,

1) That the documents directed to **Coolvision Ltd.** have been served\*

o The 12/5/2014

o At 6 Ha-barzel St. Ramat Hachayal, Tel-Aviv

- In one of the following methods authorized by Article 5:

a) In accordance with the provisions of sub-paragraph (a) of the first paragraph of Article 5 of the Convention\*.

The documents referred to in the request have been delivered to:

- o identity and description of person:
- o relationship to the addressee: Authorized Signer

In conformity with the second paragraph of Article 12 of the Convention, the applicant is requested to pay or reimburse the expenses detailed in the attached statement\*.

*Annexes*

Documents returned: .....

In appropriate cases, documents establishing the service:

.....

Done at Jerusalem, the



1-252/14



**REQUEST FOR SERVICE ABROAD  
OF JUDICIAL OR EXTRAJUDICIAL DOCUMENTS**

Convention on the Service Abroad of Judicial and Extrajudicial Documents in Civil or  
Commercial Matters, signed at The Hague, the 15th of November 1965

Identity and address of the applicant	Address of receiving authority
<b>John Pierceall, Attorney Ancillary Legal Corporation 74 Goldrush Circle Atlanta, GA 30328, USA John.pierceall@ancillarylegal.com 404-459-8006 (Fax) 404-459-0916</b>	<b>The Director of Courts Directorate of Courts 22 Kanfei Nesharin St. Jerusalem 95464 Israel Phone: 972 2 655 6847 Fax: 972 2 655 6954</b>

The undersigned applicant has the honour to transmit -- in duplicate -- the documents listed below and, in conformity with Article 5 of the above-mentioned Convention, requests prompt service of one copy thereof on the addressee, i.e.

**Coolvision Ltd.  
6 Ha-barzel St.,  
Ramat Hachayal,  
Tel Aviv, Israel**

**( x ) (a) in accordance with the provisions of sub-paragraph (a) of the first paragraph of Article 5 of the Convention.\***

**( ) (b) in accordance with the following particular method (sub-paragraph (b) of the first paragraph of Article 5):\***

**( ) (c) by delivery to the addressee, if the addressee accepts it voluntarily (second paragraph of Article 5)\***

The authority is requested to return or to have returned to the applicant a copy of the documents - and of the annexes \* - with a certificate as provided on the next page.

List of documents:

**Summons, First Amended Complaint for Patent Infringement, Complaint for Patent Infringement, Certification Pursuant to Local Rule 11.2, Plaintiff WAG Acquisition, LLC's Corporate Disclosure Statement, and attached Exhibits**

**Done at Atlanta, GA, USA, April 29, 2014**

Signature and/or stamp

**John Pierceall, Esq., Ancillary Legal Corporation,  
74 Goldrush Circle, Atlanta, GA 30328 USA  
404-459-8006, john.pierceall@ancillarylegal.com**

## CERTIFICATE

The undersigned authority has the honour to certify, in conformity with Article 6 of the Convention,

1) \* that the document has been served

- the (date)
- at (place, street, number)
- in one of the following methods authorized by Article 5:

( ) (a) in accordance with the provisions of sub-paragraph (a) of the first paragraph of Article 5 of the Convention.\*

( ) (b) in accordance with the following particular method:\*

( ) (c) by delivery to the addressee, who accepted it voluntarily.\*

The documents referred to in the request have been delivered to:

- (identity and description of person)
- relationship to the addressee (family, business or other):

2) \* that the document has not been served, by reason of the following facts:

In conformity with the second paragraph of Article 12 of the Convention, the applicant is requested to pay or reimburse the expenses detailed in the attached statement. \*

--ANNEXES-Documents returned:

In appropriate cases, documents establishing the service:

Done at , the

Signature and/or stamp



## SUMMARY OF THE DOCUMENT TO BE SERVED

Convention on the Service Abroad of Judicial and Extrajudicial Documents in Civil or  
Commercial Matters,  
signed at The Hague, the 15th of November 1965

(Article 5, fourth paragraph)

Identité et adresse du destinataire / **Identity and address of the addressee /**

**Coolvision Ltd.  
6 Ha-barzel St.,  
Ramat Hachayal,  
Tel Aviv, Israel**

### IMPORTANT

LE DOCUMENT CI-JOINT EST DE NATURE JURIDIQUE ET PEUT AFFECTER VOS DROITS  
ETOBLIGATIONS. LES ((ELEMENTS ESSENTIELS DE L'ACTB> VOUS DONNENT  
QUELQUESINFORMATIONS SUR SA NATURE ET SON OBJET. IL EST TOUTE FOIS  
INDISPENSABLE DE LIREATTENTIVEMENT LE TEXTE MEME DU DOCUMENT. IL PEUT  
ETRE NECESSAIRE DE DEMANDER UN AVIS JURIDIQUE.

SI VOS RESSOURCES SONT INSUFFISANTES, RENSEIGNEZ-VOUS SUR LA POSSIBILITE  
D'OBTENIR L'ASSISTANCE JUDICIAIRE ET LA CONSULTATION JURIDIQUE SOIT DANS  
VOTRE PAYS SOIT DANS LE PAYS D'ORIGINE DU DOCUMENT.

LES DEMANDES DE RENSEIGNEMENTS SUR LES POSSIBILITES D'OBTENIR  
L'ASSISTANCE JUDICIAIRE OU LA CONSULTATION JURIDIQUE DANS LE PAYS D'ORIGINE  
PEUVENT ETRE ADRESSEES A:

### IMPORTANT

*THE ENCLOSED DOCUMENT IS OF A LEGAL NATURE AND MAY AFFECT YOUR RIGHTS  
AND OBLIGATIONS. THE 'SUMMARY OF THE DOCUMENT TO BE SERVED' WILL GIVE YOU  
SOME INFORMATION ABOUT ITS NATURE AND PURPOSE. YOU SHOULD HOWEVER  
READ THE DOCUMENT ITSELF CAREFULLY. IT MAY BE NECESSARY TO SEEK LEGAL  
ADVICE.*

*IF YOUR FINANCIAL RESOURCES ARE INSUFFICIENT YOU SHOULD SEEK INFORMATION  
ON THE POSSIBILITY OF OBTAINING LEGAL AID OR ADVICE EITHER IN THE COUNTRY  
WHERE YOU LIVE OR IN THE COUNTRY WHERE THE DOCUMENT WAS ISSUED.*

ENQUIRIES ABOUT THE AVAILABILITY OF LEGAL AID OR ADVICE IN THE COUNTRY  
WHERE THE DOCUMENT WAS ISSUED MAY BE DIRECTED TO:

Il est recommandé que les mentions imprimées dans cette note soient rédigées en langue  
française et en langue anglaise et le cas échéant, en outre, dans la langue ou l'une des langues  
officielles de l'Etat d'origine de l'acte. Les blancs pourraient être remplis soit dans la langue de  
l'Etat où le document doit être adressé, soit en langue française, soit en langue anglaise.

*It is recommended that the standard terms in the notice be written in English and French and  
where appropriate also in the official language, or one of the official languages of the State in  
which the document originated. The blanks could be completed either/n the language of the State  
to which the documents is to be sent, or in English or Fr*

Name and address of the requesting authority:

**John Pierceall, Attorney, Ancillary Legal Corporation  
74 Goldrush Circle  
Atlanta, GA 30328 USA**

Particulars of the parties: \*

**WAG Acquisition, LLC, Plaintiff by Attorneys Ronald Abramson and David G. Liston,  
Lewis Baach PLLC, The Chrysler Building, 405 Lexington Avenue, New York, New York  
10174 USA, Telephone number 212-826-7001 vs. Coolvision Ltd. et al., 6 Ha-barzel St.,  
Ramat Hachayal, Tel Aviv, Israel  
Case filed in the United States District Court, District of New Jersey; Case number 2:14-  
CV-01661-ES-JAD**

**JUDICIAL DOCUMENT \*\***

Nature and purpose of the document:

**To initiate complaint for patent infringement**

Nature and purpose of the proceeding and, where appropriate, the amount in dispute:  
**Plaintiff demands for a trial by jury, and requests an entry of judgment in its favor and  
against the defendants as follows: declaration that defendants have each infringed United  
States Patent Nos. 8,122,141, 8,327,011, 8,185,611 and 8,364,839; declaration that each of  
defendants' infringement has been willful, and award plaintiff enhanced damages as a  
result under 35 U.S.C. § 284, jointly and severally against defendants; permanently  
enjoining defendants and all those in participation with them from continued infringement;  
to award the plaintiff past and future damages arising out of defendants infringement,  
together with prejudgment and post-judgment interest, in an amount according to proof,  
jointly and severally against defendants; to award plaintiff attorneys' fees, costs, or other  
damages pursuant to 35 U.S.C. §§ 284 or 285 or as otherwise permitted by law, jointly and  
severally against defendants; and for such other costs and further relief as the Court may  
deem just and proper**

Date and place for entering appearance: \*\*

**You must file an answer to the complaint in this action with the Court at 225 Cadman Plaza  
E., New York, New York 11201 USA and serve a copy of your answer on the plaintiff's  
attorneys Ronald Abramson and David G. Liston at 405 Lexington Avenue, New York, New  
York 10174 USA within 21 days after service of the documents, not including the day you  
received them**

Time limits stated in the document: \*\*

**File your answer with the Court and serve a copy on the plaintiff's attorneys within 21 days  
after receiving the documents (not including the day you received them)**

**UNITED STATES DISTRICT COURT**  
**DISTRICT OF NEW JERSEY**

**WAG ACQUISITION, L.L.C.,**  
*Plaintiff*

**V.**

**SUMMONS IN A CIVIL CASE**

**SOBONITO INVESTMENTS, LTD., ET AL.,**  
*Defendant*

**CASE NUMBER: 2:14-CV-01661-ES-JAD**

**TO:** *(Name and address of Defendant):*

A lawsuit has been filed against you.

Within 21 days after service of this summons on you (not counting the day you received it) — or 60 days if you are the United States or a United States Agency, or an office or employee of the United States described in Fed. R. civ. P. 12 (a)(2) or (3) — you must serve on the plaintiff an answer to the attached complaint or a motion under rule 12 of the Federal Rules of Civil Procedure. The answer or motion must be served on the plaintiff or plaintiff's attorney, whose name and address are:

If you fail to respond, judgment by default will be entered against you for the relief demanded in the complaint. You also must file your answer or motion with the court.

**WILLIAM T. WALSH**

CLERK

**LEROY DUNBAR**

(By) DEPUTY CLERK



**ISSUED ON 2014-03-17 14:38:40.0, Clerk**  
**USDC NJD**

Ronald Abramson  
David G. Liston  
**LEWIS BAACH pllc**  
The Chrysler Building  
405 Lexington Avenue  
New York, NY 10174  
Tel: (212) 826-7001

*Attorneys for Plaintiff*

**UNITED STATES DISTRICT COURT  
FOR THE DISTRICT OF NEW JERSEY**

**WAG ACQUISITION, L.L.C.,**

Plaintiff,

v.

**SOBONITO INVESTMENTS, LTD.,  
COOLVISION LTD., I.M.L. SLU, and  
DOES 1-20,**

Defendants.

Civil Action No.: 2:14-cv-01661-ES-JAD

**FIRST AMENDED COMPLAINT  
FOR PATENT INFRINGEMENT  
AND JURY TRIAL DEMAND**

**COMPLAINT FOR PATENT INFRINGEMENT**

Plaintiff WAG ACQUISITION, L.L.C., for its complaint against Defendants, alleges infringement of United States Patent Nos. 8,122,141, 8,327,011, 8,185,611, and 8,364,839 (the "patents-in-suit"). Plaintiff alleges that Defendants directly and indirectly infringe the patents-in-suit in their Internet delivery of live adult video web cam performances, as more particularly specified herein.



**THE PARTIES**

1. Plaintiff WAG Acquisition, L.L.C. is a New Jersey limited liability company with its principal place of business at 3 Gold Mine Road, Suite 104, Flanders, New Jersey 07836.

2. On information and belief, Defendant Sobonito Investments, Ltd. ("Sobonito") is a corporation organized under the laws of Cyprus with its principal place of business in Cyprus and a business address at 41 East 11th Street, New York, New York 10003.

3. On information and belief, Defendant Coolvision Ltd. ("Coolvision") is a corporation organized under the laws of Israel with its principal place of business at 6 Ha-barzel St., Ramat Hachayal, Tel Aviv, Israel.

4. On information and belief, Defendant I.M.L. SLU ("Imlive") is a company organized under the laws of the Principality of Andorra, with its principal place of business at Edifici Burges, Avinguda Sant Antoni 27, La Massana, AD 400, Principat D'Andorra.

5. On information and belief, Defendants DOE 1 – DOE 20 are entities whose precise identities are unknown to Plaintiff at this time, which operate in concert with the above-named defendants and infringe or induce or contribute to infringement of Plaintiff's patents.

**JURISDICTION AND VENUE**

6. The Court has subject matter jurisdiction pursuant to 28 U.S.C. §§ 1331 and 1338(a) because this action arises under the patent laws of the United States, 35 U.S.C. §§ 1 et seq.

7. Venue is proper in this district pursuant to 28 U.S.C. §§ 1391(b)-(c) and 1400(b).

**PLAINTIFF'S DEVELOPMENTS AND BUSINESS**

8. Plaintiff, operating under the trade name SurferNETWORK, is in the business of providing Internet broadcasting services for live and on-demand audio and video program material. Plaintiff began this business in 1998, and has been one of the leading providers of such services to the terrestrial radio stations and other content providers that comprise its customer base.

9. Early in developing its business, two of Plaintiff's principals, William A. Grywalski, ("Grywalski") and Harry Emerson ("Emerson"), recognized a need that existed in the field due to the shortcomings in then current Internet streaming technologies. They observed that long startup delays due to "buffering" and frequent program interruptions (sometimes referred to as "jitter") made the experience of trying to listen to or view streaming Internet content frustrating to the end user, and therefore impractical as a content delivery mechanism. They were interested in making the Internet streaming experience more like radio or television, including the immediacy of having the programming appear to start instantly on demand (e.g., turning on a radio or flipping channels), and continue playing once started without random interruptions.

10. Plaintiff engaged the assistance of a software design engineer, Harold Price ("Price"), to develop solutions for the shortcomings they saw in the current technology, with respect to streaming media playback performance, as well as other

technological issues concerning Internet delivery of broadcast media. Price worked on several aspects of this matter for Plaintiff over the period 1999-2001.

11. Price was aware of the then current approach to streaming, which attempted to overcome streaming transmission delays and jitter by a variety of techniques, including, for example, establishing a 20-second or so content buffer on the receiving (user or "client") end of the communication, within the client's media player or media player browser plugin. After the user selected (e.g., clicked on) a stream, the player would start filling this buffer at the playback rate and then start playing when the buffer was full. While this method did provide some protection against interruptions for the duration of whatever content was initially buffered, it entailed an undesirable startup delay for "buffering," and provided no means for graceful recovery once the 20 seconds worth of content in the buffer was used up.

12. Price conceived of solutions to these problems. He built a prototype that implemented one embodiment of those solutions, and demonstrated that a system according to his new design could overcome the problems put to him by Grywalski and Emerson.

13. Plaintiff and its predecessors in interest filed a number of U.S. patent applications on these developments, as enumerated below. To date, this family of patent applications has resulted in seven issued U.S. patents, including the patents-in-suit. All of these patent applications were assigned to Plaintiff, or to a predecessor-in-interest of Plaintiff and reassigned to Plaintiff.

14. Plaintiff has been conducting an active, operating business ever since the developments described above, and has actively practiced under the technology

taught in the patents-in-suit, from then to the present. Plaintiff has developed commercial arrangements under which it provides the service of streaming content for numerous terrestrial radio stations and content providers in New Jersey, regionally, nationally, and internationally. It also provides a One-Click Royalty Reporter™ for radio stations to report streaming media performance royalty information to SoundExchange, among other services.

15. Despite its successes, Plaintiff's business has been damaged by infringement such as that practiced by the Defendants.

#### **THE PATENTS-IN-SUIT**

16. United States Patent No. 8,122,141 (the '141 patent") was duly and legally issued on February 21, 2012 for an invention entitled "STREAMING MEDIA BUFFERING SYSTEM." Plaintiff is the owner by assignment of the '141 patent and owns all rights to recover for past infringement thereof.

17. United States Patent No. 8,327,011 (the '011 patent") was duly and legally issued on December 4, 2012 for an invention entitled "STREAMING MEDIA BUFFERING SYSTEM." Plaintiff is the owner by assignment of the '011 patent and owns all rights to recover for past infringement thereof.

18. United States Patent No. 8,185,611 (the '611 patent") was duly and legally issued on May 22, 2012, for an invention entitled "STREAMING MEDIA DELIVERY SYSTEM." Plaintiff is the owner by assignment of the '611 patent and owns all rights to recover for past infringement thereof.

19. United States Patent No. 8,364,839 (the '839 patent") was duly and legally issued on January 29, 2013, for an invention entitled "STREAMING MEDIA

DELIVERY SYSTEM.” Plaintiff is the owner by assignment of the ’839 patent and owns all rights to recover for past infringement thereof.

### **DEFENDANTS’ ACTIVITIES**

20. Defendants are in the business of providing live adult webcam performances over the Internet. Defendants arrange for numerous individuals to perform in front of video cameras and to feed the streams of these performances to server installations under defendants’ ownership or control. The performances are distributed from there, in real time, to Internet viewers around the world, on diverse systems, including without limitation desktop computers, as well as Apple® iOS, Android™, and Blackberry® smartphones and tablets. Defendants provide interactive facilities for users to communicate requests and comments to the performers, and for Defendants to charge the users’ credit cards for their use of the system and the tips they give to the performers. Defendants aggressively market these services to a worldwide audience, including a substantial volume of users in this District, from which defendants derive substantial revenues.

21. Adult streaming media is an extremely high volume business, which is well known as consuming a high percentage of the total bandwidth available on the Internet. Operating in this market requires sophisticated technology and complex infrastructure.

22. While the operational demands of the adult streaming business entail high infrastructure cost, the market for Defendants’ services is also very large, making the business extremely lucrative.



23. Success in Defendants' business is highly dependent on fast, smooth, uninterrupted delivery of streaming media content, such as that made possible by Plaintiff's patents. Defendants derive great value as a result of operating under Plaintiff's patented technology, for which they have not compensated Plaintiff.

24. On information and belief, Defendants Sobonito and Coolvision are the financial and operational masterminds behind Defendants' infringing operations. They have recruited a large number of webcam performers in Eastern Europe and elsewhere and assembled Internet distribution, billing, and syndication platforms for their performances, to form a global pornography enterprise that reaches all parts of the world. On information and belief, Defendants' retinue of live performers include New Jersey residents, who perform online over Defendants' infringing services, from New Jersey, using facilities provided by Defendants.

25. On information and belief, Defendant Imlive operates the web site Imlive.com, which serves as Defendants' the "flagship" site for streaming webcam performances originating from Defendants' global enterprises. Imlive streams these performances over a variety of delivery technologies to, inter alia, desktop computers and mobile devices, including without limitation smartphones and tablets operating under the iOS and Android operating systems, in a manner that infringes Plaintiff's patents.

26. On information and belief, Defendant Imlive also operates the web sites Pussycash.com and Webcamwiz.com, which provide "Affiliate" programs for Defendants. Under the Affiliate programs, Defendants' Imlive.com and other webcam sites are "white labeled" to other Internet service providers on a revenue

splitting basis. Under such white labeling, providers of other prominent pornography sites (frequently “tube” sites offering short, low-quality clips on a free basis) provide a paid, revenue-generating webcam adjunct service under the provider’s own branding, which will appear to the user as a click-through or pop-under site. Though branded to look like the provider’s tube site, the affiliated webcam site is actually provided by Imlive and/or one of the Defendants named herein. The affiliate provider and such Defendant will generally split the revenue resulting from the white-labeled site.

27. On information and belief, defendants DOE 1– DOE 20 are operators of “affiliated” web sites that are cosmetically modified versions of Imlive.com or others of Defendants’ webcam sites carrying the DOE defendants’ branding. On information and belief, DOES 1-20 have revenue split deals with the other Defendants named herein, under which they take a substantial share in revenues derived from infringing Plaintiff’s patents.

28. Defendants have infringed and are continuing to infringe Plaintiff’s patents, including at least the patents-in-suit. Defendants’ servers are configured to stream Defendants’ live webcam performances and other video streams over a variety of delivery technologies to, *inter alia*, the smartphones, tablets, browsers and other mobile platforms (“Mobile Platforms”), and desktop computers (“Desktop Platforms”), in a manner that infringes Plaintiff’s patents. Defendants employ different techniques to stream video to Mobile Platforms and Desktop Platforms, which techniques infringe Plaintiff’s patents in different respects.

**COUNT I: INFRINGEMENT OF THE '141 PATENT**

29. Plaintiff repeats and realleges the allegations of paragraphs 1-28 above as if fully set forth at length herein.

30. Defendants have infringed and continue to infringe the '141 patent by providing live streaming performances over the Internet to, *inter alia*, Mobile Platforms, through their manufacture, distribution, use, sale, importation, and/or offer for sale of systems, methods, products, and processes for:

- creating or storing on their servers streaming media from a live source (or from a disk file) in a form comprising a plurality of sequential media data elements, which are identified by serial identifiers,
- programming the servers to receive requests from user systems for media data elements corresponding to serial identifiers specified in the requests,
- programming the servers to send the media data elements responsive to the user requests, with the result that the streaming media contained in the media data elements are sent to the user at a rate more rapid than its playback rate,
- sending software to the user to implement a media player on the user's system for receiving streaming media from Defendants' specially programmed servers, and for playing the streaming media so received,
- programming the media player as sent to the user, to cause it to maintain a record of the identifier of the last data element that has been received,
- programming the media player as sent to the user, to transmit to the server requests to send one or more data elements, specifying the identifier of the data elements, as required by the media player to maintain a sufficient number of media data elements in the media player for uninterrupted playback,

and additionally and alternatively by their contributing to and inducement of others to manufacture, use, sell, import, and/or offer for sale infringing systems, methods, products, and processes in the manners described above. Defendants are liable for their infringement of the '141 patent pursuant to 35 U.S.C. §§ 271(a)-(c).

31. Defendants' acts of infringement have caused and are continuing to cause damage to Plaintiff, and Plaintiff is entitled to recover from Defendants the damages sustained by Plaintiff as a result of Defendants' infringing acts in an amount subject to proof at trial.

32. Defendants' widespread infringement has injured Plaintiff's ability to expand its operations based on its patented technology. Plaintiff's remedy in damages for such continuing infringing activity is inadequate to fully compensate Plaintiff for the invasion of its exclusive rights, and Plaintiff is entitled to an injunction to protect its business against such continuing infringement.

## **COUNT II: INFRINGEMENT OF THE '011 PATENT**

33. Plaintiff repeats and realleges the allegations of paragraphs 1-32 above as if fully set forth at length herein.

34. Defendants have and are continuing to infringe the '011 patent by their manufacture, distribution, use, sale, importation, and/or offer for sale of software components to combine with a user's processor, memory, and network connection, specially adapted to create, *inter alia*, on Mobile Platforms, a media player for the user to interact with Defendants' media servers (which provide streaming media as a series of sequentially identified data elements), the software components comprising:

- instructions to cause the media player to request from the media source a predetermined number of media data elements,
- instructions to cause the media player to receive media data elements sent to the media player by the media source and store the media data elements in the player memory,
- instructions to implement a player buffer manager to maintain a record of the serial number of the last media data element received and stored in a player buffer in the player memory,
- instructions to cause the media player to play the media data elements sequentially from the player buffer,
- instructions to cause the media player to request media data elements from the server by serial number and to repeat such requests so as to maintain a pre-determined number of media data elements in the player buffer,

and additionally and alternatively by their contributing to and inducement of others to manufacture, use, sell, import, and/or offer for sale infringing systems, methods, products, and processes in the manners described above. Defendants are liable for their infringement of the '011 patent pursuant to 35 U.S.C. §§ 271(a)-(c).

35. Defendants' acts of infringement have caused and are continuing to cause damage to Plaintiff, and Plaintiff is entitled to recover from Defendants the damages sustained by Plaintiff as a result of Defendants' infringing acts in an amount subject to proof at trial.

36. Defendants' widespread infringement has injured Plaintiff's ability to expand its operations based on its patented technology. Plaintiff's remedy in damages for such continuing infringing activity is inadequate to fully compensate Plaintiff for the invasion of its exclusive rights, and Plaintiff is entitled to an injunction to protect its business against such continuing infringement.



**COUNT III: INFRINGEMENT OF THE '611 PATENT**

37. Plaintiff repeats and realleges the allegations of paragraphs 1-36 above as if fully set forth at length herein.

38. Defendants have and continue to directly and indirectly infringe at least at least claims 1-2, 6-7, 8, 10-11 and 14 of the '611 patent, in their manner of providing streaming performances over the Internet. Such infringement occurs as a result of Defendants' streaming of live performance webcam video to Desktop Platforms, in which Defendants perform, use, or provide, without limitation, methods and systems for the following:

- sending initial streaming media elements to the user system at an initial sending rate more rapid than the playback rate, to fill the user buffer, configuring the elements so that the amount of the initial elements and the initial sending rate are sufficient for the user system to begin playing back the streaming media while the user buffer continues to fill, and
- thereafter, sending further streaming media data elements to the user system at about the playback rate, which matches the rate at which the server buffer is filled from the live performance, and where the further streaming data elements are received by the user's computer at about the playback rate if there are no interruptions in the transmission of media data between the server and the user's computer.

As a consequence of said acts, and variations thereof as recited in the identified claims, all of which are performed or provided by Defendants, Defendants are liable for their infringement of the '611 patent pursuant to 35 U.S.C. § 271(a)-(c).

39. Defendants' acts of infringement have caused and are continuing to cause damage to Plaintiff, and Plaintiff is entitled to recover from Defendants the damages sustained by Plaintiff as a result of Defendants' infringing acts in an amount subject to proof at trial.

40. Defendants' widespread infringement has injured Plaintiff's ability to expand its operations based on its patented technology. Plaintiff's remedy in damages for such continuing infringing activity is inadequate to fully compensate Plaintiff for the invasion of its exclusive rights, and Plaintiff is entitled to an injunction to protect its business against such continuing infringement.

#### **COUNT IV: INFRINGEMENT OF THE '839 PATENT**

41. Plaintiff repeats and realleges the allegations of paragraphs 1-40 above as if fully set forth at length herein.

42. Defendants have and continue to directly and indirectly infringe at least at least claims 1, 3-5, 7-8, 10-12, 13-14, 15, 17-19, and 21 of the '839 patent, in their manner of providing streaming performances over the Internet. Such infringement occurs as a result of Defendants' streaming of live performance webcam video to Desktop Platforms, in which Defendants perform, use, or provide, without limitation, methods and systems for the following:

- loading a server buffer with streaming media data elements,
- sending an initial amount of streaming media data elements to the user system at an initial sending rate more rapid than the playback rate, such that the user system can begin playing back the program while the user buffer continues to fill,
- thereafter, sending further streaming media data elements to the user system at about the playback rate and filling the server buffer at about the playback rate, where the further streaming data elements are received by the user's computer at about the playback rate if there are no interruptions in the transmission of media data between the server and the user's computer.

As a consequence of said acts, and variations thereof as recited in the identified claims, all of which are performed or provided by Defendants, Defendants are liable for their infringement of the '839 patent pursuant to 35 U.S.C. § 271(a)-(c).

43. Defendants' acts of infringement have caused and are continuing to cause damage to Plaintiff, and Plaintiff is entitled to recover from Defendants the damages sustained by Plaintiff as a result of Defendants' infringing acts in an amount subject to proof at trial.

44. Defendants' widespread infringement has injured Plaintiff's ability to expand its operations based on its patented technology. Plaintiff's remedy in damages for such continuing infringing activity is inadequate to fully compensate Plaintiff for the invasion of its exclusive rights, and Plaintiff is entitled to an injunction to protect its business against such continuing infringement.

#### **COUNT V: WILLFUL INFRINGEMENT**

45. Plaintiff repeats and realleges the allegations of paragraphs 1-44 above as if fully set forth at length herein.

46. The filing of this action for infringement constitutes notice to Defendants of such infringement, pursuant to 35 U.S.C. § 287. At least upon receipt of such notice Defendants should have understood that there was an objectively high likelihood that their actions thereafter constituted patent infringement.

47. Defendants' continued infringement at least after such notice is willful and deliberate, entitling Plaintiff to increased damages under 35 U.S.C. § 284 and to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

**JURY DEMAND**

48. Plaintiff demands trial by jury on all issues.

**PRAYER FOR RELIEF**

WHEREFORE, Plaintiff WAG ACQUISITION, L.L.C. requests an entry of judgment in its favor and against Defendants as follows:

a) Declaration that Defendants have each infringed United States Patent Nos. 8,122,141, 8,327,011, 8,185,611, and 8,364,839;

b) Declaration that each of Defendants' infringement has been willful, and awarding enhanced damages and fees as a result of that willfulness under 35 U.S.C. § 284, jointly and severally against the Defendants;

c) Permanently enjoining Defendants, their officers, directors, employees, agents, and all those in concert and participation with them from continued infringement of infringed United States Patent Nos. 8,122,141, 8,327,011, 8,185,611, and 8,364,839;

d) Awarding the past and future damages arising out of Defendants' infringement of United States Patent Nos. 8,122,141, 8,327,011, 8,185,611, and 8,364,839 to Plaintiff, together with prejudgment and post-judgment interest, in an amount according to proof, jointly and severally against the Defendants;

e) Awarding attorneys' fees, costs, or other damages pursuant to 35 U.S.C. §§ 284 or 285 or as otherwise permitted by law, jointly and severally against the Defendants; and

f) For such other costs and further relief as the Court may deem just and proper.

Dated: April 24, 2014

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**UNITED STATES DISTRICT COURT  
FOR THE DISTRICT OF NEW JERSEY**

**WAG ACQUISITION, L.L.C.,**

Plaintiff,

v.

**SOBONITO INVESTMENTS, LTD.,  
COOLVISION LTD., I.M.L. SLU, and  
DOES 1-20,**

Defendants.

Civil Action No.:

**COMPLAINT FOR PATENT  
INFRINGEMENT, JURY  
TRIAL DEMAND, AND  
CERTIFICATION UNDER  
LOCAL RULE 11.2**

**COMPLAINT FOR PATENT INFRINGEMENT**

Plaintiff WAG ACQUISITION, L.L.C., for its complaint against Defendants, alleges infringement of United States Patent Nos. 8,122,141 and 8,327,011 (the "patents-in-suit"). Plaintiff alleges that Defendants directly and indirectly infringe the patents-in-suit in their Internet delivery of live adult video web cam performances, as more particularly specified herein.

### **THE PARTIES**

1. Plaintiff WAG Acquisition, L.L.C. is a New Jersey limited liability company with its principal place of business at 3 Gold Mine Road, Suite 104, Flanders, New Jersey 07836.

2. On information and belief, Defendant Sobonito Investments, Ltd. ("Sobonito") is a corporation organized under the laws of Cyprus with its principal place of business in Cyprus and a business address at 41 East 11th Street, New York, New York 10003.

3. On information and belief, Defendant Coolvision Ltd. ("Coolvision") is a corporation organized under the laws of Israel with its principal place of business at 6 Ha-barzel St., Ramat Hachayal, Tel Aviv, Israel.

4. On information and belief, Defendant I.M.L. SLU ("Imlive") is a company organized under the laws of the Principality of Andorra, with its principal place of business at Edifici Burges, Avinguda Sant Antoni 27, La Massana, AD 400, Principat D'Andorra.

5. On information and belief, Defendants DOE 1 – DOE 20 are entities whose precise identities are unknown to Plaintiff at this time, which operate in concert with the above-named defendants and infringe or induce or contribute to infringement of Plaintiff's patents.

### **JURISDICTION AND VENUE**

6. The Court has subject matter jurisdiction pursuant to 28 U.S.C. §§ 1331 and 1338(a) because this action arises under the patent laws of the United States, 35 U.S.C. §§ 1 et seq.

7. Venue is proper in this district pursuant to 28 U.S.C. §§ 1391(b)-(c) and 1400(b).

### **PLAINTIFF'S DEVELOPMENTS AND BUSINESS**

8. Plaintiff, operating under the trade name SurferNETWORK, is in the business of providing Internet broadcasting services for live and on-demand audio and video program material. Plaintiff began this business in 1998, and has been one of the leading providers of such services to the terrestrial radio stations and other content providers that comprise its customer base.

9. Early in developing its business, two of Plaintiff's principals, William A. Grywalski, ("Grywalski") and Harry Emerson ("Emerson"), recognized a need that existed in the field due to the shortcomings in then current Internet streaming technologies. They observed that long startup delays due to "buffering" and frequent program interruptions (sometimes referred to as "jitter") made the experience of trying to listen to or view streaming Internet content frustrating to the end user, and therefore impractical as a content delivery mechanism. They were interested in making the Internet streaming experience more like radio or television, including the immediacy of having the programming appear to start instantly on demand (e.g., turning on a radio or flipping channels), and continue playing once started without random interruptions.

10. Plaintiff engaged the assistance of a software design engineer, Harold Price ("Price"), to develop solutions for the shortcomings they saw in the current technology, with respect to streaming media playback performance, as well as other

technological issues concerning Internet delivery of broadcast media. Price worked on several aspects of this matter for Plaintiff over the period 1999-2001.

11. Price was aware of the then current approach to streaming, which attempted to overcome streaming transmission delays and jitter by a variety of techniques, including, for example, establishing a 20-second or so content buffer on the receiving (user or "client") end of the communication, within the client's media player or media player browser plugin. After the user selected (e.g., clicked on) a stream, the player would start filling this buffer at the playback rate and then start playing when the buffer was full. While this method did provide some protection against interruptions for the duration of whatever content was initially buffered, it entailed an undesirable startup delay for "buffering," and provided no means for graceful recovery once the 20 seconds worth of content in the buffer was used up.

12. Price conceived of solutions to these problems. He built a prototype that implemented one embodiment of those solutions, and demonstrated that a system according to his new design could overcome the problems put to him by Grywalski and Emerson.

13. Plaintiff and its predecessors in interest filed a number of U.S. patent applications on these developments, as enumerated below. To date, this family of patent applications has resulted in seven issued U.S. patents, including the two patents-in-suit. All of these patent applications were assigned to Plaintiff, or to a predecessor-in-interest of Plaintiff and reassigned to Plaintiff.

14. Plaintiff has been conducting an active, operating business ever since the developments described above, and has actively practiced under the technology

taught in the patents-in-suit, from then to the present. Plaintiff has developed commercial arrangements under which it provides the service of streaming content for numerous terrestrial radio stations and content providers in New Jersey, regionally, nationally, and internationally. It also provides a One-Click Royalty Reporter™ for radio stations to report streaming media performance royalty information to SoundExchange, among other services.

15. Despite its successes, Plaintiff's business has been damaged by infringement such as that practiced by the Defendants.

#### **THE PATENTS-IN-SUIT**

16. United States Patent No. 8,122,141 (the '141 patent") was duly and legally issued on February 21, 2012 for an invention entitled "STREAMING MEDIA BUFFERING SYSTEM." Plaintiff is the owner by assignment of the '141 patent and owns all rights to recover for past infringement thereof. A copy of the '141 patent is attached hereto as Exhibit A.

17. United States Patent No. 8,327,011 (the '011 patent") was duly and legally issued on December 4, 2012 for an invention entitled "STREAMING MEDIA BUFFERING SYSTEM." Plaintiff is the owner by assignment of the '011 patent and owns all rights to recover for past infringement thereof. A copy of the '011 patent is attached hereto as Exhibit B.

#### **DEFENDANTS' ACTIVITIES**

18. Defendants are in the business of providing live adult webcam performances over the Internet. Defendants arrange for numerous individuals to



perform in front of video cameras and to feed the streams of these performances to server installations under defendants' ownership or control. The performances are distributed from there, in real time, to Internet viewers around the world, on diverse systems, including without limitation desktop computers, as well as Apple® iOS, Android™, and Blackberry® smartphones and tablets. Defendants provide interactive facilities for users to communicate requests and comments to the performers, and for Defendants to charge the users' credit cards for their use of the system and the tips they give to the performers. Defendants aggressively market these services to a worldwide audience, including a substantial volume of users in this District, from which defendants derive substantial revenues.

19. Adult streaming media is an extremely high volume business, which is well known as consuming a high percentage of the total bandwidth available on the Internet. Operating in this market requires sophisticated technology and complex infrastructure.

20. While the operational demands of the adult streaming business entail high infrastructure cost, the market for Defendants' services is also very large, making the business extremely lucrative.

21. Success in Defendants' business is highly dependent on fast, smooth, uninterrupted delivery of streaming media content, such as that made possible by Plaintiff's patents. Defendants derive great value as a result of operating under Plaintiff's patented technology, for which they have not compensated Plaintiff.

22. On information and belief, Defendants Sobonito and Coolvision are the financial and operational masterminds behind Defendants' infringing operations.

They have recruited a large number of webcam performers in Eastern Europe and elsewhere and assembled Internet distribution, billing, and syndication platforms for their performances, to form a global pornography enterprise that reaches all parts of the world.

23. On information and belief, Defendant Imlive operates the web site Imlive.com, which serves as Defendants' the "flagship" site for streaming webcam performances originating from Defendants' global enterprises. Imlive streams these performances over a variety of delivery technologies to, inter alia, desktop computers and mobile devices, including without limitation smartphones and tablets operating under the iOS and Android operating systems, in a manner that infringes Plaintiff's patents.

24. On information and belief, Defendant Imlive also operates the web sites Pussycash.com and Webcamwiz.com, which provide "Affiliate" programs for Defendants. Under the Affiliate programs, Defendants' Imlive.com and other webcam sites are "white labeled" to other Internet service providers on a revenue splitting basis. Under such white labeling, providers of other prominent pornography sites (frequently "tube" sites offering short, low-quality clips on a free basis) provide a paid, revenue-generating webcam adjunct service under the provider's own branding, which will appear to the user as a click-through or pop-under site. Though branded to look like the provider's tube site, the affiliated webcam site is actually provided by Imlive and/or one of the Defendants named herein. The affiliate provider and such Defendant will generally split the revenue resulting from the white-labeled site.

25. On information and belief, defendants DOE 1– DOE 20 are operators of “affiliated” web sites that are cosmetically modified versions of Imlive.com or others of Defendants’ webcam sites carrying the DOE defendants’ branding. On information and belief, DOES 1-20 have revenue split deals with the other Defendants named herein, under which they take a substantial share in revenues derived from infringing Plaintiff’s patents.

26. Defendants have infringed and are continuing to infringe Plaintiff’s patents, including at least the patents-in-suit.

**COUNT I: INFRINGEMENT OF THE ‘141 PATENT**

27. Plaintiff repeats and realleges the allegations of paragraphs 1-26 above as if fully set forth at length herein.

28. Defendants have infringed and continue to infringe the ‘141 patent by providing live streaming performances over the Internet through their manufacture, distribution, use, sale, importation, and/or offer for sale of systems, methods, products, and processes for:

- creating or storing on their servers streaming media from a live source (or from a disk file) in a form comprising a plurality of sequential media data elements, which are identified by serial identifiers,
- programming the servers to receive requests from user systems for media data elements corresponding to serial identifiers specified in the requests,
- programming the servers to send the media data elements responsive to the user requests, with the result that the streaming media contained in the media data elements are sent to the user at a rate more rapid than its playback rate,

- sending software to the user to implement a media player on the user's system for receiving streaming media from Defendants' specially programmed servers, and for playing the streaming media so received,
- programming the media player as sent to the user, to cause it to maintain a record of the identifier of the last data element that has been received,
- programming the media player as sent to the user, to transmit to the server requests to send one or more data elements, specifying the identifier of the data elements, as required by the media player to maintain a sufficient number of media data elements in the media player for uninterrupted playback,

and additionally and alternatively by their contributing to and inducement of others to manufacture, use, sell, import, and/or offer for sale infringing systems, methods, products, and processes in the manners described above. Defendants are liable for their infringement of the '141 patent pursuant to 35 U.S.C. §§ 271(a)-(c).

29. Defendants' acts of infringement have caused and are continuing to cause damage to Plaintiff, and Plaintiff is entitled to recover from Defendants the damages sustained by Plaintiff as a result of Defendants' infringing acts in an amount subject to proof at trial.

30. Defendants' widespread infringement has injured Plaintiff's ability to expand its operations based on its patented technology. Plaintiff's remedy in damages for such continuing infringing activity is inadequate to fully compensate Plaintiff for the invasion of its exclusive rights, and Plaintiff is entitled to an injunction to protect its business against such continuing infringement.

**COUNT II: INFRINGEMENT OF THE '011 PATENT**

31. Plaintiff repeats and realleges the allegations of paragraphs 1-30 above as if fully set forth at length herein.

32. Defendants have and are continuing to infringe the '011 patent by their manufacture, distribution, use, sale, importation, and/or offer for sale of software components to combine with a user's processor, memory, and network connection, specially adapted to create a media player for the user to interact with Defendants' media servers (which provide streaming media as a series of sequentially identified data elements), the software components comprising:

- instructions to cause the media player to request from the media source a predetermined number of media data elements,
- instructions to cause the media player to receive media data elements sent to the media player by the media source and store the media data elements in the player memory,
- instructions to implement a player buffer manager to maintain a record of the serial number of the last media data element received and stored in a player buffer in the player memory,
- instructions to cause the media player to play the media data elements sequentially from the player buffer,
- instructions to cause the media player to request media data elements from the server by serial number and to repeat such requests so as to maintain a pre-determined number of media data elements in the player buffer,

and additionally and alternatively by their contributing to and inducement of others to manufacture, use, sell, import, and/or offer for sale infringing systems, methods, products, and processes in the manners described above. Defendants are liable for their infringement of the '011 patent pursuant to 35 U.S.C. §§ 271(a)-(c).

33. Defendants' acts of infringement have caused and are continuing to cause damage to Plaintiff, and Plaintiff is entitled to recover from Defendants the damages sustained by Plaintiff as a result of Defendants' infringing acts in an amount subject to proof at trial.

34. Defendants' widespread infringement has injured Plaintiff's ability to expand its operations based on its patented technology. Plaintiff's remedy in damages for such continuing infringing activity is inadequate to fully compensate Plaintiff for the invasion of its exclusive rights, and Plaintiff is entitled to an injunction to protect its business against such continuing infringement.

### **COUNT III: WILLFUL INFRINGEMENT**

35. Plaintiff repeats and realleges the allegations of paragraphs 1-34 above as if fully set forth at length herein.

36. The filing of this action for infringement constitutes notice to Defendants of such infringement, pursuant to 35 U.S.C. § 287. At least upon receipt of such notice Defendants should have understood that there was an objectively high likelihood that their actions thereafter constituted patent infringement.

37. Defendants' continued infringement at least after such notice is willful and deliberate, entitling Plaintiff to increased damages under 35 U.S.C. § 284 and to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

### **JURY DEMAND**

38. Plaintiff demands trial by jury on all issues.

**PRAYER FOR RELIEF**

WHEREFORE, Plaintiff WAG ACQUISITION, L.L.C. requests an entry of judgment in its favor and against Defendants as follows:

a) Declaration that Defendants have each infringed United States Patent Nos. 8,122,141 and 8,327,011;

b) Declaration that each of Defendants' infringement has been willful, and awarding enhanced damages and fees as a result of that willfulness under 35 U.S.C. § 284, jointly and severally against the Defendants;

c) Permanently enjoining Defendants, their officers, directors, employees, agents, and all those in concert and participation with them from continued infringement of infringed United States Patent Nos. 8,122,141 and 8,327,011;

d) Awarding the past and future damages arising out of Defendants' infringement of United States Patent Nos. 8,122,141 and 8,327,011 to Plaintiff, together with prejudgment and post-judgment interest, in an amount according to proof, jointly and severally against the Defendants;

e) Awarding attorneys' fees, costs, or other damages pursuant to 35 U.S.C. §§ 284 or 285 or as otherwise permitted by law, jointly and severally against the Defendants; and



f) For such other costs and further relief as the Court may deem just and proper.

Dated: March 14, 2014

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**CERTIFICATION PURSUANT TO LOCAL RULE 11.2**

RONALD ABRAMSON certifies under penalty of perjury pursuant to 28 U.S.C.

§ 1746 as follows:

1. I am one of the attorneys of record herein for the Plaintiff.
2. I do hereby certify to my own knowledge and based upon information available to me at my office, that the matter in controversy is not the subject of any other action now pending in any court or in any arbitration or administrative proceeding.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on March 14, 2014.

s/ Ronald Abramson  
RONALD ABRAMSON

UNITED STATES DISTRICT COURT  
FOR THE DISTRICT OF NEW JERSEY

WAG ACQUISITION, L.L.C.,

Plaintiff,

v.

SOBONITO INVESTMENTS, LTD.,  
COOLVISION LTD., I.M.L. SLU, and DOES  
1-20,

Defendants.

Case No.: 2:14-cv-01661-ES-JAD

**PLAINTIFF WAG ACQUISITION, L.L.C.'s CORPORATE DISCLOSURE STATEMENT**

Pursuant to Federal Rule of Civil Procedure 7.1, Plaintiff WAG Acquisition, L.L.C. ("WAG") files this Corporate Disclosure Statement, stating that WAG has no parent corporation and that no publicly held corporation owns 10% or more of WAG's stock.

Dated: March 17, 2014

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Ronald Abramson

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EXHIBIT A



(12) **United States Patent**  
**Price**

(10) **Patent No.:** **US 8,122,141 B2**  
(45) **Date of Patent:** **\*Feb. 21, 2012**

(54) **STREAMING MEDIA BUFFERING SYSTEM**

(75) **Inventor:** **Harold Edward Price**, Bethel Park, PA (US)

(73) **Assignee:** **WAG Acquisition, LLC**, Flanders, NJ (US)

(\*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

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(21) **Appl. No.:** **12/800,152**

(22) **Filed:** **May 10, 2010**

(65) **Prior Publication Data**

US 2010/0235536 A1 Sep. 16, 2010

**Related U.S. Application Data**

(63) Continuation of application No. 10/893,814, filed on Jul. 19, 2004, now Pat. No. 7,716,358, which is a continuation-in-part of application No. 09/819,337, filed on Mar. 28, 2001, now Pat. No. 6,766,376.

(60) Provisional application No. 60/231,997, filed on Sep. 12, 2000.

(51) **Int. Cl.**  
**G06F 15/16** (2006.01)

(52) **U.S. Cl.** ..... **709/231**

(58) **Field of Classification Search** ..... **709/230, 709/231**

See application file for complete search history.

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*Primary Examiner* — Joseph Avellino

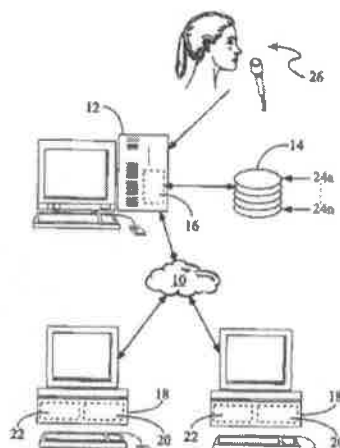
*Assistant Examiner* — Marshall McLeod

(74) *Attorney, Agent, or Firm* — Ernest D. Buff; Ernest D. Buff & Assoc. LLC; Gordon E. Fish

(57) **ABSTRACT**

Streaming media, such as audio or video files, is sent via the Internet. The media are immediately played on a user's computer. Audio/video data is transmitted from the server more rapidly than it is played out by the user system. The audio/video data in the user buffer accumulates; and interruptions in playback as well as temporary modem delays are avoided.

**28 Claims, 3 Drawing Sheets**



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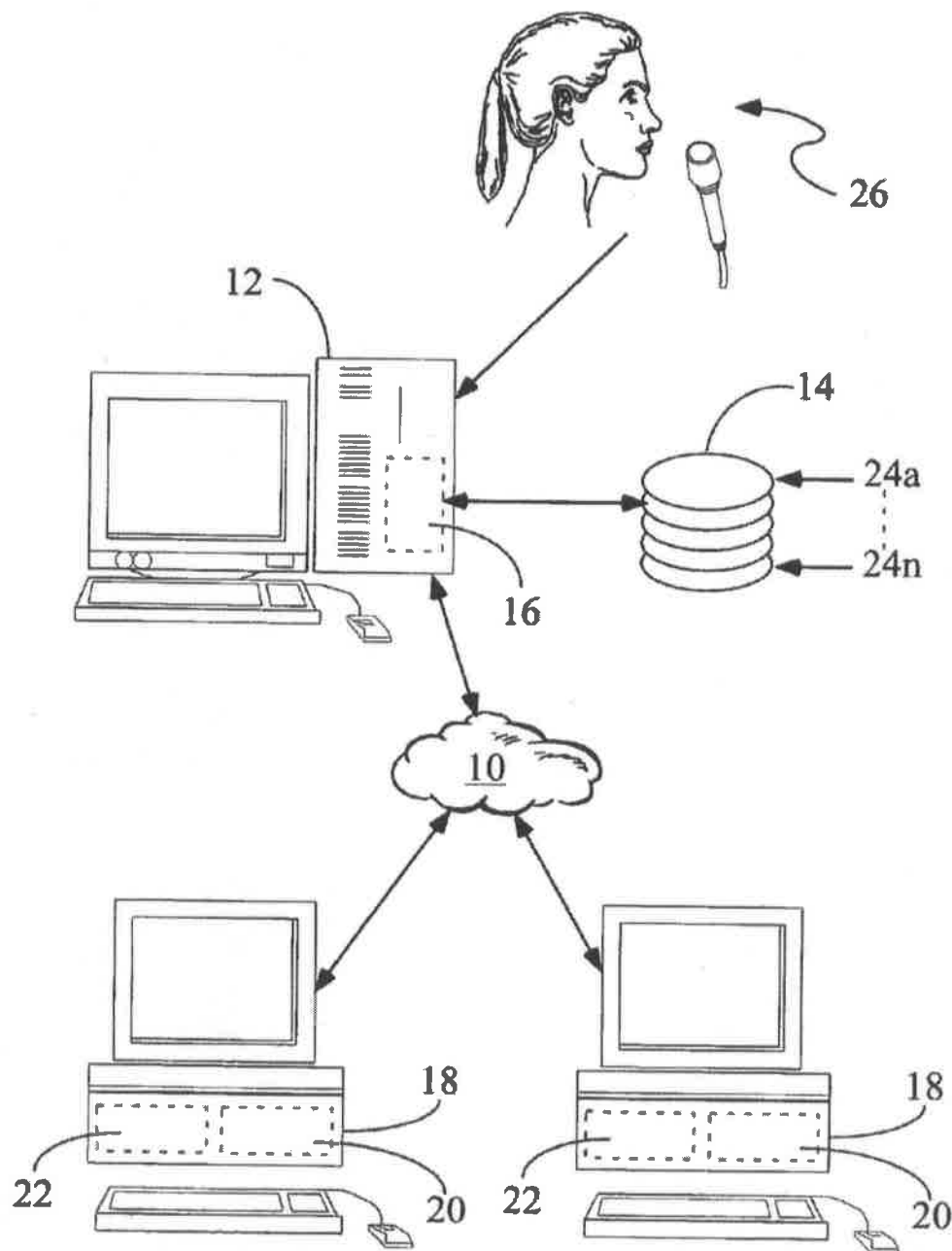
U.S. Patent

Feb. 21, 2012

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Fig. 1





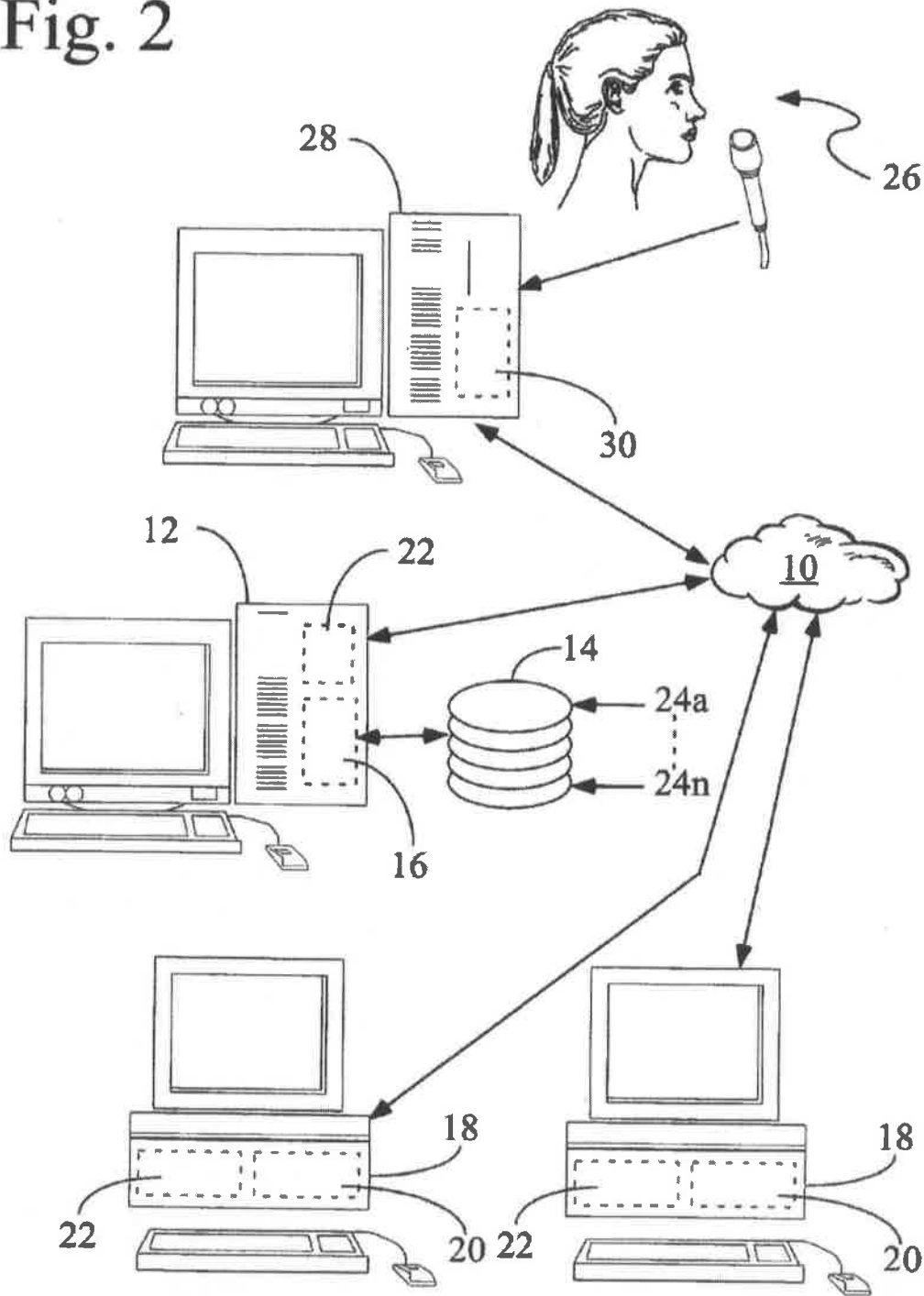
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Feb. 21, 2012

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Fig. 2



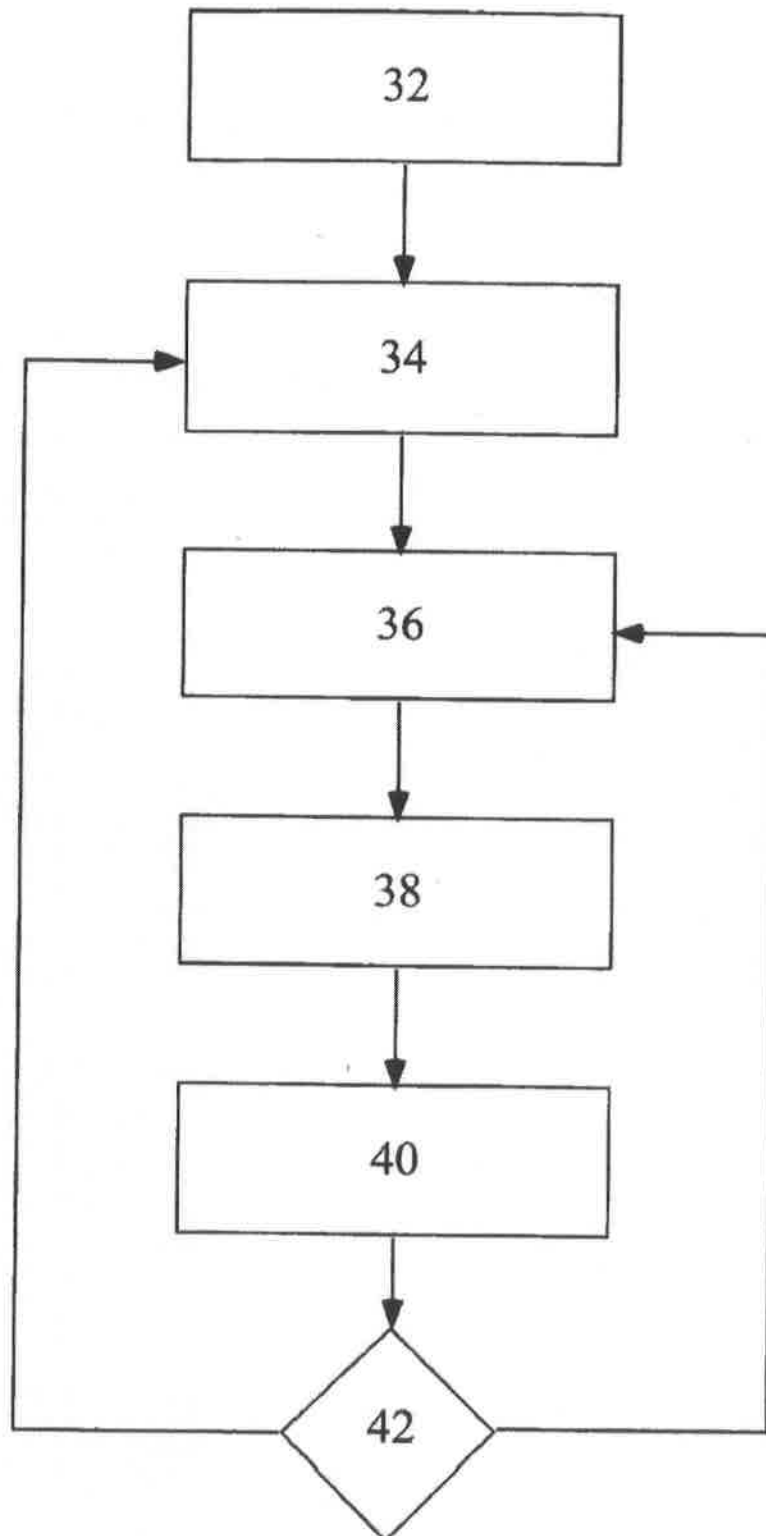
**U.S. Patent**

**Feb. 21, 2012**

**Sheet 3 of 3**

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**Fig. 3**



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## STREAMING MEDIA BUFFERING SYSTEM

### CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 10/893,814, filed Jul. 19, 2004 (published on Dec. 9, 2004 as U.S. patent publication number 2004/0249969 A1, and now U.S. Pat. No. 7,716,358), which was a continuation-in-part of U.S. patent application Ser. No. 09/819,337, filed Mar. 28, 2001 (now U.S. Pat. No. 6,766,376), which claimed the benefit under 35 U.S.C. §119(e) of U.S. provisional patent application Ser. No. 60/231,997, filed Sep. 12, 2000; claims the benefit, under 35 U.S.C. §120, of the respective filing dates of said applications, as well as benefit of the filing date of copending U.S. patent application Ser. No. 10/825,869, filed Apr. 16, 2004 (published on Dec. 23, 2004 as U.S. patent publication number 2004/260828 A1), which was a continuation of said U.S. patent application Ser. No. 09/819,337, filed Mar. 28, 2001 (now U.S. Pat. No. 6,766,376), which claimed the benefit under 35 U.S.C. §119(e) of said U.S. provisional patent application Ser. No. 60/231,997, filed Sep. 12, 2000; and hereby incorporates by reference the entire disclosure of each of said prior applications.

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

The present invention relates to multimedia computer communication systems; and more particularly, to a buffering system for streaming media, such as audio/video, on the Internet.

#### 2. Description of the Related Art

Prior to the development of Internet streaming media technologies, audio and video were formatted into files, which users needed to download to their computer before the files could be heard or viewed. Real time, continuous media, as from a radio station, was not suitable for this arrangement in that a file of finite size must be created so it could be downloaded. The advent of streaming media technologies allowed users to listen or view the files as they were being downloaded, and allowed users to "tune-in" to a continuous media broadcast, or "stream", such as from a radio station. There are two fundamental types of streaming media: (i) material that originates from a source having a real-time nature, such as a radio or TV broadcast, and (ii) material that originates from a non-real-time source such as from a disk file. An example of non-real-time material might be a piece of music stored as a disk file, or a portion of a broadcast that originally was real-time, perhaps yesterday's TV evening news, and was recorded into a disk file. For purposes of clarity within this document, streaming media of type (i) will be referred to as "broadcast" media, and streaming media of type (ii) will be referred to as "file based" media. Broadcast streaming media has as its source a system or arrangement that by definition can only be transmitted to users as fast as the material is generated; for example, a disk jockey speaking into a microphone. Broadcast streaming media is the focus of this patent application.

Since audio and video media must play out over a period of time it is more appropriate to think of bandwidth requirements than file size. The bandwidth requirement of an audio or video media refers to the data rate in bits per second that must be transmitted and received in order to listen or view the material uninterrupted. Transmitting the audio or video material over a connection slower than the bandwidth requirement

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results in unsatisfactory viewing or listening, if viewing or listening is possible at all. The connection available to most Internet users is by dial-up modem, which has a maximum receive data rate of 56,000 bits per second. Most audio and video available on the Internet has been compressed to be listenable or viewable within the 56,000 bits per second modem bandwidth. Requirements for achieving adequate audio and video over the Internet generally consume a considerable portion of the listener's available bandwidth.

Internet connection quality can vary rapidly over time, with two primary factors responsible for degradation of the instantaneous bandwidth actually available to the user. These factors are the quality of the user's modem connection over telephone lines, which can have periods of interference causing reduced available bandwidth, and momentary Internet congestion at various points along the route over which the user's data flows. Each of these factors can cause delays and interruptions in the transmission of data to the user. Internet data communications devices such as routers are designed to drop data "packets" if they get overloaded. For material that is not time sensitive, these dropped packets will usually be resent, and the user will eventually be presented with the material. However, since streaming media is time sensitive, dropped packets can have a significant impact on the receipt and playback of an audio or video stream. These degradations in the receipt of Internet data are very common, and prevent most users from being able to listen to or view streaming media without interruption unless some special provisions have been incorporated into the user's computer software to accommodate data transmission interruptions.

These interruptions are commonly referred to as "drop-outs", meaning that the data flow to the user has been interrupted (i.e., the audio "drops out"). Dropouts can be extremely annoying—for example, while listening to music. The current state-of-the-art solution to the problem uses a pre-buffering technique to store up enough audio or video data in the user's computer so that it can play the audio or video with a minimum of dropouts. This process requires the user to wait until enough of the media file is buffered in memory before listening or viewing can begin. The media data is delivered by a server computer which has available to it the source of the media data, such as by a connection to a radio station. When the user connects to the server via the Internet, audio/video output at the user's system is delayed while the user's buffer is filled to a predetermined level. Typical pre-buffering wait times range from 10 to 20 seconds or more, determined by the vendor providing the audio or video media. Even with this pre-buffering process, interruptions in playback still occur.

In this process, the user has a software application on the computer commonly called a "media player". Using the features built into the media player, the user starts the audio or video stream, typically by clicking on a "start" button, and waits 10-20 seconds or so before the material starts playing. During this time data is being received from the source and filling the media player's buffer. The audio or video data is delivered from the source at the rate it is to be played out. If, for example, the user is listening to an audio stream encoded to be played-out at 24,000 bits per second, the source sends the audio data at the rate of 24,000 bits per second. Provided that the user waits 10 seconds, and the receipt of the buffering data has not been interrupted, there is enough media data stored in the buffer to play for 10 seconds.

Gaps in the receipt of audio/video data, due to Internet slowdowns, cause the buffer to deplete. Because transmission of audio/video media data to the user takes place at the rate it is played out, the user's buffer level can never be increased or

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replenished while it is playing. Thus, gaps in the receipt of audio/video media data inexorably cause the buffer level to decrease from its initial level. In time, extended or repeated occurrences of these gaps empty the user's buffer. The audio/video material stops playing, and the buffer must be refilled to its original predetermined level before playing of the media resumes.

By way of illustration in a 10 second pre-buffering scenario, if the data reception stopped the instant that the media started playing, it would play for exactly 10 seconds. Once it starts playing, the media data plays out of the buffer as new media data replenishes the buffer. The incoming data rate equals the rate at which the data is played out of the user's buffer, assuming the receipt of data across the Internet is unimpeded. If there are no interruptions in the receipt of the media data for the duration of the time the user listens to or watches the material, the buffer level remains constant and there will still be 10 seconds of data stored in the media player's buffer when the user stops the player. On the other hand, if the media player encounters interruptions totaling 6 seconds while playing the material, there would only be 4 seconds of media data remaining in the buffer when the user stopped it. If data reception interruptions at any time during the playing exceed 10 seconds, the user's media player buffer becomes exhausted. There is no media data to play, and the audio or video stops—a dropout has occurred. At this point a software mechanism in the media player stops attempting to play any more of the material, and starts the buffering process again. The media player remains silent until the buffer refills, at which time the media player will once again start playing the material.

There are two fundamental types of streaming media: (i) material that originates from a source having a real-time nature, such as a radio or TV broadcast, and (ii) material that originates from a non-real-time source such as from a disk file. An example of non-real-time material might be a piece of music stored as a disk file, or a portion of a broadcast that originally was real-time, perhaps yesterday's TV evening news, and was recorded into a disk file. For purposes of clarity within this document, streaming media of type (i) will be referred to as "broadcast" media, and streaming media of type (ii) will be referred to as "file based" media.

Both streaming media types are handled similarly in conventional systems, and both are handled similarly by the streaming media buffering system of the present invention. The two streaming media types are readily distinguished. Broadcast streaming media has as its source a system or arrangement that by definition can only be transmitted to users as fast as the material is generated; for example, a disk jockey speaking into a microphone. File based media, on the other hand, can be transmitted to users at any data rate, since there is no inherent time element to a file residing on a computer disk. With conventional Internet streaming media systems for streaming media of either type, media data is transmitted from the server to the user at the rate at which it will be played out, regardless of the data rate capabilities of the connection between the server and the user.

Conventional streaming media systems may incorporate buffering systems for programmatic purposes. For example, the system may buffer media data at the server for the purpose of packet assembly/disassembly. Media data may also be buffered at the server to permit programming conveniences such as dealing with chunks of data of a specific size. Such server buffering of media data is not used by conventional streaming media systems to mitigate long term Internet performance degradation as described hereinafter.

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The sending of audio or video files via a network is known in the art. U.S. Pat. No. 6,029,194 to Tilt describes a media server for the distribution of audio/video over networks, in which retrieved media frames are transferred to a FIFO buffer. A clock rate for a local clock is adjusted according to the fullness of the buffer. The media frames from the buffer are sent in the form of data packets over the networks in response to interrupts generated by the local clock. In this manner, the timing for the media frames is controlled by the user to assure a continuous stream of video during editing. U.S. Pat. No. 6,014,706 to Cannon, et al. discloses an apparatus and method for displaying streamed digital video data on a client computer. The client computer is configured to receive the streamed digital video data from a server computer via a computer network. The streamed digital video data is transmitted from the server computer to the client computer as a stream of video frames. U.S. Pat. No. 6,002,720, to Yurt, et al. discloses a system of distributing video and/or audio information wherein digital signal processing is employed to achieve high rates of data compression. U.S. Pat. No. 5,923,655, to Veschi et al. discloses a system and method for communicating audio/video data in a packet-based computer network wherein transmission of data packets through the computer network requires variable periods of transmission time. U.S. Pat. No. 5,922,048 to Emura discloses a video server apparatus having a stream control section which determines a keyframe readout interval and a keyframe playback interval that satisfy a playback speed designated by a terminal apparatus. Finally, U.S. Pat. No. 6,014,694 to Aharoni, et al. discloses a system and method for adaptively transporting video over networks, including the Internet, wherein the available bandwidth varies with time.

There remains a need in the art for a method and system that afford immediate and uninterrupted listening/viewing of streaming media by the user.

#### SUMMARY OF THE INVENTION

The present invention provides a system and method for sending streaming media, such as audio or video files, via the Internet. Immediate playing of the media on a user's computer is afforded while reducing interruptions in playback due to Internet congestion and temporary modem delays due to noisy lines. Nearly instantaneous playback is achieved, while maintaining protection against playback interruption. Delayed starts, heretofore required to provide protection against interruption, are avoided. Data loss due to interruptions in the receipt of media data by the media player can be recovered while the player continues to play out the audio or video material. If the interruptions are so severe as to deplete the user's buffer and stop the play out, the media player will begin to play out again as soon as the media player begins to receive media data without waiting to first build up the buffer.

Generally stated, the invention provides a system for distributing via the Internet streaming media composed of a plurality of time-sequenced data elements. The system has a server connected to the Internet for transmitting the data elements. Associated with the server are a buffer manager and a FIFO buffer for storing at least one of the data elements for transmission. The buffer manager comprises means for: receiving the media data; supplying media data in order to the FIFO buffer; supplying the FIFO buffer with a predetermined number of data elements; maintaining a pointer into the buffer for each user computer indicating the last media data element that has been sent to that user, thus indicating the next element or elements to be sent; and, once the FIFO buffer is full, deleting the oldest data elements in the buffer as new data



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elements are received, said means arranged to maintain the pre-determined number of data elements in the FIFO buffer. At least one user computer is connected to the server via the Internet or other data communications medium.

This invention presumes the existence of a data communications transport mechanism, such as the TCP protocol, for the reliable delivery of data in an ordered sequence from the source of the media data to the server, or from the server to the media player software of the user computer. Thus, the delivery of data in the proper sequence is outside the scope of this invention.

The user computer is associated with a media player software incorporating a user buffer and comprises means for receiving and storing a predetermined number of media data elements which are received sequentially by the media player, playing the data out sequentially as audio and/or video, and deleting media data elements from the buffer as they are played out. As data is played out, the next sequential data elements are received from the server in such a fashion as to approximately maintain the predetermined number of data elements in the user's buffer.

There are two types of encoding schemes used for audio and video material—"Variable Bit Rate"—VBR, and "Constant Bit Rate"—CBR. CBR encoding represents the encoded media with a constant bit rate per second, regardless of the complexity of the material being encoded, for example, if an audio source is encoded at 20 kilobits per second at a Constant Bit Rate, the media data being produced from the encoding is at 20 kilobits per second whether the audio material is symphonic music or silence. Variable Bit Rate encoding uses a variable number of bits to represent sounds, with more bits required for complex (symphonic) sounds than for simple sounds or silence. The standard encoding scheme used for streaming media is CBR because the resulting data rate is more predictable than for VBR.

The server stores a predetermined amount of media data in a First-In First-Out (FIFO) buffer in an arrangement that receives media data directly or indirectly from a real-time source, such as a radio station. For example, the server buffer might be set to store up 30 seconds of media data. Because the source produces media data in real time, the media data is delivered to the server approximately at the rate it is generated. Of course there can be variability's in this data delivery process due to networking, disk accesses, and so on, causing the delivery rate of the media data to be variable over short periods of time, typically measured in seconds. But over a longer period of time measured in minutes or tens of minutes or longer, the media data is delivered from source to server at the rate it is generated, and the server in turn provides that media data to the FIFO buffer at that same rate. Since CBR encoding is normally used for streaming media, the media data is generated, received by the server, and provided to the buffer approximately at a fixed rate. Once the buffer is full, for each new data element received into the buffer the oldest data element is deleted from the buffer. Once a connection is made to a user's computer, the server sends the media data to the user computer's buffer in the following manner. First, media data is sent to the user at the highest rate that the data connection between the server and the user computer will support until the predetermined amount of data that had been stored in the server buffer has been transferred to the user's computer. Once the buffer has been transferred a steady state condition is reached wherein as each media data element arrives at the server, it is immediately sent out to the user computer. In this steady state condition, the media data is sent at a rate that matches the constant fill rate of the server buffer, and is received at the same rate by the user computer if there are no

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interruptions in the transmission of media data between the server and the user's computer. If interruptions have interfered with the arrival of sent media data to the user's computer, that data may have been "dropped" by routers in the Internet and needs to be resent. This causes data to "back up" into the server FIFO for that user.

In one method of operation, the resending of missing data is the responsibility of a reliable transport mechanism, such as TCP. The server buffer "sends" data by delivering it to the transport mechanism. The transport mechanism actually "sends" the data across the communications medium, and has processes which determine if all the data that has been sent has been received by the destination. If not, missing pieces of data are automatically resent to the destination, and are arranged to be delivered to the target software on the destination system in an ordered fashion. In the circumstance of this invention, the destination is the user computer, and the target software on the destination system is the media player. If the transport mechanism determines that data is missing, it retransmits that data to the destination as fast as the connection between the server and destination will allow. The net effect of this invention is that all media data to be delivered to a user computer is always sent as fast as the communications medium will support, either by the server buffer passing media data to the transport mechanism, or by the transport mechanism delivering or redelivering the media data to the user computer. This is enabled by buffering data at the server, and is distinctly different from prior art in which media data is only sent from the server to the user computer at the rate at which it is to be played out.

In another method of operation, the server can use an unreliable transport mechanism, such as UDP, and rely on a streaming software process to manage data delivery and the resending of data elements not received by the media player.

As an example of the preceding description, if the server had been set to store 30 seconds of audio in its buffer, when a user connects that 30 seconds worth of media, data is transferred to the user's media player buffer as fast as the data connection between the two will allow. The media player can begin playing as soon as it has received a very minimum amount of data, perhaps comprising only a single packet of media data. For ease of understanding, consider the server buffer and the media player buffer to be an elastic system that between the two stores up 30 seconds of audio data. The server starts with 30 seconds of buffered audio data which it transfers to the media player until the server has no buffered media data and the media player has 30 seconds of buffered media data. Regardless of how much of the buffered media data has been transmitted to the media player, there always is 30 seconds of media data being buffered between the two locations. Consequently, the audio being played out by the media player will always be 30 seconds behind the audio at the source. If there were a media player in the radio station studio, an announcer would hear themselves through the media player with a 30 second delay.

Routinely, once a steady state has been achieved, the next data element to be sent is the next sequential data element from that which has already been received by the user's computer buffer. However, if there is more data to be sent than at the routine constant fill rate, such as in the condition where some media data has been resent by the reliable transport layer, the server transport mechanism will again send the buffered media data as fast as the connection between the server and the user's computer will support. Similarly, if the media player buffer begins to deplete or becomes depleted due to networking interruptions, the server will attempt to send as much data as is necessary to rebuild the user comput-

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er's buffer to the proper level. This allows for rebuilding the user's computer buffer under circumstances wherein Internet interruptions have blocked the normal flow of data. When compared to conventional systems, which provide no capability to rebuild the user's computer buffer when data is lost, the streaming media buffering system of the present invention provides for recovery of lost data elements and the restoration of the user's buffer, even while the user media player continues to play.

Under conditions in which interruptions have interfered with the arrival of sent media data to the user's computer, data loss exceeding certain levels will cause the transport mechanism software to stop accepting data for transmission from the application software, namely the streaming media server software. Although other arrangements are possible within the scope of this invention, in the preferred embodiment, the streaming media server software keeps track of the last data element in the FIFO buffer that has been "sent" to each user using a software pointer. An interruption in the ability to send media data to a user results in this pointer "backing up" in the FIFO in such a way that the server knows from what point in the buffer to restart sending data when the transport mechanism again requests data to send. When the server software receives that notification, it will begin sending data to the user starting from the next data element to send as indicated by the pointer, and sending as much data as the transport mechanism will accept. The transport mechanism will again send this data as fast as it can to the user. This process continues until the steady state condition is again reached wherein each data element is sent to the user as soon as it arrives from the media source.

In another embodiment, the server is connected to the Internet, and to a broadcast media source, such as a radio station. A radio station computer is provided with a means for receiving media data elements as they are generated by the audio and/or video source, and for transmitting those media data elements to the server as they are generated. As before, the server provides a buffer manager and a FIFO buffer, and provides a means for receiving the sequentially arranged media data elements from the broadcast media source and storing those data elements in the FIFO buffer. The buffer manager comprises means for: supplying the FIFO buffer with a predetermined number of data elements; maintaining a pointer into the buffer for each user computer indicating the last media data element that has been sent to that user, thus indicating the next element or elements to be sent; and, once the FIFO buffer is full, deleting the oldest data element in the buffer as each new data element is received. Importantly, the buffer manager is arranged to maintain the pre-determined number of data elements in the FIFO buffer. At least one user computer is connected to the server via the Internet or other data communications medium.

The user computer is associated with a media player software incorporating a user buffer and comprises means for receiving and storing a predetermined number of media data elements, playing the data out sequentially as audio and/or video, and deleting media data elements from the buffer as they are played out. As data is played out, the next sequential data elements are received from the server in such a fashion as to approximately maintain the predetermined number of data elements in the user's buffer. It should be understood that data might arrive at the media player out-of-sequence and that processes in the media player or the media player buffer manager are responsible for properly arranging this data.

In another embodiment, the server is connected to the Internet and provisioned as initially described, and has available to it file based media data as the source material. The file

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based media data can be read by the server which can deliver media data elements to the server FIFO buffer at a constant time-sequenced rate, as if the data were arriving from a broadcast media source. As before, the server provides a buffer manager and a FIFO buffer, and provides a means for receiving the sequentially arranged media data elements from the file based media source and storing those data elements in the FIFO buffer. The buffer manager comprises means for: receiving the media data; supplying media data in order to the FIFO buffer; supplying the FIFO buffer with a predetermined number of data elements at a constant time-sequenced fill rate; maintaining a pointer into the buffer for each user computer indicating the last media data element that has been sent to that user, thus indicating the next element or elements to be sent; and, once the FIFO buffer is full, deleting the oldest data element in the buffer as each new data element is received, said means arranged to maintain the pre-determined number of data elements in the FIFO buffer. The server buffer manager, or a separate process on the server, or a process on another computer having access to the file based media data, provides for reading the media data file and making available to the FIFO buffer sequentially arranged media data elements. At least one user computer is connected to the server via the Internet.

The user computer is associated with a media player software incorporating a user buffer and comprises means for receiving and storing a predetermined number of media data elements, which are received sequentially by the media player, playing the data out sequentially as audio and/or video, and deleting media data elements from the buffer as they are played out. As data is played out, the next sequential data elements are received from the server in such a fashion as to approximately maintain the predetermined number of data elements in the user's buffer.

In another embodiment, the server is connected to the Internet and provisioned as initially described. The server buffer manager, or the media source, provides for sequentially numbering the media data elements. The server buffer manager does not maintain a pointer into the server buffer for each user. Instead, the media player buffer manager in the user computer maintains a record of the serial number of the last data element that has been received. Via the use of standard data communications protocol techniques such as TCP, the user computer transmits a request to the server to send one or more data elements, specifying the serial numbers of the data elements. The server responds by sending the requested data elements, and depends upon the reliable transmission protocol to assure delivery. The user computer then continues with additional data requests for the duration of playing the audio/video material. In this manner, the user computer, not the server, maintains the record of the highest data element number stored in the user computer buffer. The media data will be transmitted to the user computer as fast as the data connection between the user computer and the server will allow. As before, the server provides a buffer manager and a FIFO buffer, and provides a means for receiving the sequential media data elements from a broadcast media source or a file based media source, and storing those data elements in the FIFO buffer. The buffer manager comprises means for: receiving the media data; supplying media data in order to the FIFO buffer; supplying the FIFO buffer with a predetermined number of data elements; and, once the FIFO buffer is full, deleting the oldest data element in the buffer as each new data element is received. Such means is arranged to maintain the pre-determined number of data elements in the FIFO buffer. At least one user computer is connected to the server via the Internet.



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The user computer is associated with a media player software incorporating a user buffer and comprises means for receiving and storing a predetermined number of media data elements, playing the data out sequentially as audio and/or video, and deleting media data elements from the buffer as they are played out. As data is played out, the next sequential data elements are requested from the server in such a fashion as to approximately maintain the predetermined number of data elements in the user's buffer. It should be understood that data might arrive at the media player out-of-sequence and that processes in the media player or the media player buffer manager are responsible for properly arranging this data.

In yet another embodiment, the invention provides a method for distributing from a server via the Internet streaming media composed of a plurality of time-sequenced data elements. A predetermined number of the data elements are sequentially loaded into a FIFO buffer. Additional data elements continue to be received. As each new data element is input to the buffer, the oldest data element is deleted from the buffer, maintaining in the buffer the same predetermined number of data elements. At the request of a user computer for connection to a media stream, a group of the data elements is sequentially sent via the Internet from the FIFO buffer to the user computer connected to the Internet. Upon being received by the user computer, the sent group of data elements is loaded into a user's buffer associated with the user computer. The user's computer immediately begins to play the audio/video streaming media material. The server continues to send the next data elements in sequence until the contents of the FIFO buffer have been sent. The data elements are sent by the server as fast as the connection between the server and user computer will allow. Once the contents of the FIFO buffer have been sent to a user computer, as each new data element is received into the FIFO buffer it is immediately sent to the user computer in such a manner as to keep the user computer buffer full. The process repeats for substantially the entire time that the audio/video material is played.

Unlike conventional buffering systems, audio begins to play on the user system as soon as the user connection to the audio server is effected and a small amount of data has been transferred-conventional systems required many seconds of data. Audio/video media data is initially transmitted from the server more rapidly than it is played out by the user system, until the server buffer has been transferred to the user computer. The user's buffer is built up while the audio is playing, and can be restored if it is diminished by data transmission interruptions. Advantageously, the system and method of this invention afford faster data transmissions than the playback data rate of the media data. Audio/video data is transmitted from the server more rapidly than it is played out by the user system under conditions wherein the user's computer buffer is not full. The audio/video data in the user buffer accumulates; interruptions in playback due to temporary Internet and modem delays are avoided. It should be realized that, although the invention has been described hereinabove in connection with a process wherein the server sends buffered media data to the user "as fast as the network connection will permit", it is adequate, as mentioned in this paragraph, that the buffered data be transferred from the server to the user at a rate faster than the playback rate.

Although the preferred embodiment utilizes a reliable transport mechanism to move data between the server and the user, alternative embodiments could incorporate this invention's buffering system in combination with an unreliable datagram-based transport mechanism.

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## BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be more fully understood and further advantages will become apparent when reference is had to the following detailed description and the accompanying drawings, in which:

FIG. 1 is a schematic diagram illustrating the elements of a streaming media buffering system in accordance with the present invention;

FIG. 2 is a schematic diagram of an alternative embodiment of the system shown by FIG. 1; and

FIG. 3 is a block diagram illustrating the method of the present invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention relates to a buffering system for streaming media, such as audio/video, on the Internet.

In one embodiment, the invention provides a system for distributing via the Internet streaming media composed of a plurality of time-sequenced data elements. As shown in FIG. 1, the system is provided with a server 12 connected to the Internet 10 for transmitting the streaming media data elements. Associated with the server 12 is a FIFO buffer 14 for storing at least one of the data elements for transmission, and a buffer manager 16. Buffer 14 is a conventional computer storage mechanism such as a hard disk, as shown for convenience of illustration, or, preferably, an electronic storage arrangement such as Random Access Memory (RAM). The buffer manager 16 is in the form of software or firmware that provides means for: receiving the media data; supplying media data in order to the FIFO buffer; supplying the buffer 14 with a predetermined number of data elements; maintaining a pointer 24a through 24n into the buffer, one for each user computer indicating the last media data element that has been sent to that user, thus indicating the next element or elements to be sent; and, once the FIFO buffer is full, deleting the oldest data element in the buffer as each new data element is received, said means arranged to maintain the pre-determined number of data elements in the FIFO buffer. Buffer Manager 16 may also comprise means for: formatting media data according to the requirements of buffer 14, and for digitizing, encoding, and packetizing the media data.

There is at least one user computer 18 connected to the server 12 via the Internet 10. A user buffer 20 is associated with the user computer 18. The user buffer 20 is provided with means for storing a predetermined number of the data elements. User buffer 20 is a conventional computer storage mechanism such as a hard disk, or, preferably, an electronic storage arrangement such as Random Access Memory (RAM) as suggested by the illustration. A buffer manager 22 is associated with the user computer 18. The buffer manager 22, having the form of software or firmware, is provided with means for receiving and storing a predetermined number of media data elements which are received by the media player, playing the data out sequentially as audio and/or video, and deleting media data elements from the buffer as they are played out.

The media may come from a live source, shown as 26 in FIG. 1, or from a stored file on the server 12, or another storage device, such as a hard drive. For broadcast media, as the term is used herein, such as an announcer speaking into a microphone, or playing a CD, the media source 26 can only transmit audio/video data as fast as it is generated. If the media source is file based, such as a music clip stored as a disk file, and if that disk file is stored on the server or an associated



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server computer, this connection could be considered to be near instantaneous. In this case, rather than audio/video data filling and depleting the buffer 14, an amount of audio/video data equivalent to the desired buffer size is logically constituted as a FIFO buffer. Such a construct is commonly called a data window. The data window moves on a time-sequenced basis through the media data file, thus defining the contents of the buffer on a moment-by-moment basis and performing the equivalent functions to receiving a new data element and deleting the oldest data element.

The server 12 maintains a buffer of audio/video data comprising an amount adequate to bridge gaps typical of Internet and modem delays to the user. Preferably, this buffer holds enough data elements for about one minute of play. The server buffer 14 is filled the first time the media source connection is established or a disk file is read.

Connections from the server 12 through the Internet 10 commonly are much faster than the data rate required for audio or video playback. This fact is insignificant for conventional servers because, not having a FIFO buffer or a buffer pointer for each user, audio/video data can only be sent as fast as it becomes available, or as fast as the pace at which it must be delivered to the user in order to be properly replayed. The user, typically interacting with "media player" software on their computer, selects an audio source requiring a data rate slower than that available by the user's connection to the Internet. For example, if the user's connection to the Internet is made via a 56,000 bits per second modem, the user might select a media source encoded for playback at 24,000 bits per second.

With the present invention, as soon as a user connects to the server 12, the server 12 transmits audio/video data as sequential data elements from its buffer 14 to the buffer 20 of the user as fast as the data connection will allow. Unlike the prior art, media begins to play on the user computer 18 as soon as the user connection is made to the audio server 12 and a minimal amount of data elements have been received and stored in the user's buffer 20. The user's buffer 20 is built up while the media is playing. As each data element is played, it is deleted from the user's buffer 20. Initially, the user buffer manager 22 requests the server 12 to send media data elements to start the playback stream, such as by selecting a radio station from a list. The server 12 responds by sending data elements to the user computer 18 as fast as it can, until the entire FIFO buffer 14 has been sent to the user computer. Upon receipt of the initial data elements, the user buffer manager 22 begins playback. Because this is a synchronous system with the source, server, and user computer operating by the same playback clock rate as determined by the encoding rate of the media, as each data element is played out and is deleted from the user buffer 20, another data element has been deposited into the server buffer 14 and is available to be sent to the user computer. Server 12 sends the newly available data elements as fast as the data rate of the connection between server 12 and user computer 18 will allow.

Since the connection from the Internet to the user is faster than that required for media playback, audio/video data is transmitted from the server faster than it is played out by the user system, thus building up audio/video data in the user buffer. For example, if the user's connection to the Internet is at 56,000 bits per second, and the data rate encoded for the media to be played is 24,000 bits per second, the buffer level of the user buffer 20 will fill at the rate of 32,000 bits per second (56,000 bits per second receive rate, minus 24,000 bits per second playback depletion rate).

If, for example, the server buffer 14 held one minute of audio/video data, eventually the user buffer 20 will hold one

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minute of audio/video data. The effect is that, over a brief period of time, the server buffer 14, or a designated portion of it, is transferred to the user buffer 20. The number of data elements in the server buffer 14 actually never changes, it always maintains one minute of audio/video data. However, for the particular user under discussion, a copy of all the data held in the buffer has been sent to the user. Since the user buffer 20 now holds one minute of audio/video data, it can play continuously despite data reception interruptions of less than a minute, and as soon as the interruption ceases the user buffer 20 can begin to rebuild, which will take place as fast as the connection between the user computer 18 and the server 12 will allow. The media player can continue to play out the audio/video material while the user buffer 20 rebuilds.

The predetermined buffer level in the user buffer 20 may be set at less than the predetermined buffer level of the server buffer 14 if desired. For example, the server buffer 14 might be set to hold one minute of media data, and the user buffer 20 might be set to hold thirty seconds of media data.

Alternatively, the user computer is replaced by an Internet radio or Internet Appliance, which is comprised of a dedicated processor for receiving Internet radio or audio/video material. Examples of such devices might range from familiar computing devices such as palmtops, PDAs (Portable Digital Assistants), and wireless phones, to devices that appear and operate similarly to conventional consumer electronic devices such as radios and televisions, but with the additional capability of Internet access.

In another embodiment, as shown in FIG. 2, the media source may be remote from the server 12, such as a computer system 28 in a radio station studio. This computer includes a source manager 30 which may be implemented in software or firmware. The source manager 30 comprises means for: formatting media data according to the requirements of server 12, buffer 14, and buffer manager 16; and, for transmitting that media data to server 12. Source manager 30 may further include means for digitizing, encoding, and packetizing the media data. Media data typically is generated in real time such as by a speaker talking into a microphone or by playing a CD. Generally, computer system 28 transmits media data to server 12 in real time as the media data is generated. Buffering of media data might occur at computer system 28 for convenience of programming, but such buffering is incidental to the operation of the end-to-end system being described. Computer system 28 connects via the Internet 10, or other suitable data communications medium, to a server 12, wherein server buffer manager 16 receives the media data for input into the FIFO buffer 14 as described previously. Server 12, in turn, transmits the media data to one or more user computers 18, also as previously described. Network connections between the source computer and the server may cause media data to be delayed in arrival at the server, causing the server FIFO buffer occasionally to be less than full. In this circumstance, the server buffer transfers the media data that it has available in its buffer to the media player, and when more data arrives from the source, the server sends it out to the media player.

In another embodiment, shown in FIG. 3, the invention provides a method for distributing from a server via the Internet streaming media composed of a plurality of time-sequenced data elements. Time-sequenced data elements are generated or received 32. Next, a predetermined number of the data elements are sequentially loaded 34 into a server buffer, which process of 32 and 34 continues indefinitely as long as there is media data available. Next, a group of the data elements is sequentially sent 36 via the Internet from the server buffer to a user computer connected to the Internet. Upon receipt by the user computer, the sent group of data

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elements is loaded 38 into a user buffer associated with the user computer. The user computer immediately plays 40 the received portion of the media on the user computer. At 42, if the user buffer is not full, then additional data elements are sent to the user computer 36. And also at 42, if the user buffer is full, the system waits until new media data is delivered to the server buffer 34. This process is repeated until the entire media file is played at the user computer.

Unlike conventional buffer arrangements, audio begins to play on the user system as soon as the user connection is made to the audio server. The user's buffer is built up while the audio is playing. Advantageously, the system and method of this invention create a faster than real time connection. That is to say, audio/video data is transmitted from the server faster than it is played out by the user system, thus building up audio/video data in the user buffer.

Having thus described the invention in rather full detail, it will be understood that such detail need not be strictly adhered to, but that additional changes and modifications may suggest themselves to one skilled in the art, all falling within the scope of the invention as defined by the subjoined claims.

I claim:

1. A method for distributing streaming media via a data communications medium such as the Internet to at least one user system of at least one user, the streaming media comprising a plurality of sequential media data elements for a digitally encoded audio or video program, comprising

providing a server programmed to receive requests from the user system for media data elements corresponding to specified serial identifiers and to send media data elements to the user system responsive to said requests, at a rate more rapid than the rate at which said streaming media is played back by a user; and

providing a machine-readable medium accessible to said user, on which there has been recorded software for implementing a media player for receiving and playing the streaming media on said user system, said software being programmed to cause the media player to maintain a record of the identifier of the last data element that has been received; and to transmit requests to the server to send one or more data elements, specifying the identifiers of the data elements, as said media player requires in order to maintain a sufficient number of media data elements in the media player for uninterrupted playback.

2. The method of claim 1, wherein said serial identifiers are sequential.

3. The method of claim 1, wherein said media is encoded at a constant bit rate.

4. The method of claim 1, wherein said media is encoded at a variable bit rate.

5. The method of claim 1, further comprising distributing said streaming media to a plurality of users.

6. The method of claim 5, wherein said server does not maintain a pointer into a buffer established within said server, for each said user.

7. The method of claim 1, wherein said server is adapted to receive said requests from said user system via standard communications protocol techniques such as TCP.

8. The method of claim 1, wherein said server obtains said streaming media from a live source.

9. The method of claim 1, wherein said server obtains said streaming media from a disk file.

10. A server for distributing streaming media via a data communications medium such as the Internet to at least one user system of at least one user, the streaming media comprising a plurality of sequential media data elements for a digitally encoded audio or video program, said user system

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being assumed to have a media player for receiving and playing the streaming media on said user system, which is operable to obtain media data elements from said server by transmitting requests to said server to send one or more specified media data elements, said server comprising

at least one data storage device, memory for storing machine-readable executable routines and for providing a working memory area for routines executing on the server, a central processing unit for executing the machine-readable executable routines, an operating system, at least one connection to the communications medium, and a communications system providing a set of communications protocols for communicating through said at least one connection;

a machine-readable, executable routine containing instructions to cause the server to assign serial identifiers to the sequential media data elements comprising the program;

a machine-readable, executable routine containing instructions to cause the server to receive requests from the user system for one or more media data elements specifying the identifiers of the requested data elements; and

a machine-readable, executable routine containing instructions to cause the server to send media data elements to the user system responsive to said requests, at a rate more rapid than the rate at which said streaming media is played back by a user.

11. The server of claim 10, wherein said serial identifiers are sequential.

12. The server of claim 10, wherein said media is encoded at a constant bit rate.

13. The server of claim 10, wherein said media is encoded at a variable bit rate.

14. The server of claim 10, wherein said server is adapted to distribute said streaming media to a plurality of simultaneous users.

15. The server of claim 10, wherein said server does not maintain a pointer into a buffer established within said server, for each said user.

16. The server of claim 10, wherein said operating system further comprises a protocol to receive said requests from said user system via standard communications protocol techniques such as TCP.

17. The server of claim 10, wherein said server is adapted to obtain said streaming media from a live source.

18. The server of claim 10, wherein said server obtains said streaming media from a disk file.

19. A non-transitory machine-readable medium on which there has been recorded a computer program for use in operating a computer to prepare streaming media content for transmission by a server wherein said server responds to user requests for media data elements identified by a serial identifier, said program recorded on said non-transitory machine readable medium comprising a routine to store and serially identify sequential data elements comprising said streaming media content, in a format capable of being served to users by said server.

20. The non-transitory machine readable medium of claim 19, wherein said streaming media content is obtained by said computer from a disk file.

21. The non-transitory machine-readable medium of claim 19, wherein said streaming media content is obtained from a live source.

22. The non-transitory machine-readable medium of claim 19, wherein said streaming media content is encoded at a constant bit rate.

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23. The non-transitory machine-readable medium of claim 19, wherein said streaming media content is encoded at a variable bit rate.

24. A non-transitory machine-readable medium on which there has been recorded a computer program for use in operating a media player for receiving and playing streaming media comprising a plurality of sequential media data elements, said elements being available on request by said player via a data communications medium such as the Internet, from a server assumed to be capable of sending streaming media elements at a rate more rapid than the rate at which said streaming media is played back by a user, each said data element having a serial identifier, said program recorded on said machine readable medium comprising:

a routine that maintains a record of the identifier of the last sequential media data element that has been received by said player;

a routine that requests transmission of the next sequential media data elements following said last sequential

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media data element, as said media player requires in order to maintain a sufficient number of media data elements in the media player for uninterrupted playback.

25. The non-transitory machine-readable medium of claim 24, wherein said streaming media content is encoded at a constant bit rate.

26. The non-transitory machine-readable medium of claim 24, wherein said streaming media content is encoded at a variable bit rate.

27. The non-transitory machine-readable medium of claim 24, further comprising routines to send said requests to said server via standard communications protocol techniques such as TCP.

28. The method of claim 1, wherein said server assigns serial identifiers to the sequential media data elements comprising the program.

\* \* \* \* \*



EXHIBIT B

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(12) **United States Patent**  
**Price**(10) **Patent No.:** **US 8,327,011 B2**(45) **Date of Patent:** **Dec. 4, 2012**(54) **STREAMING MEDIA BUFFERING SYSTEM**(75) **Inventor:** **Harold Edward Price, Bethel Park, PA (US)**(73) **Assignee:** **WAG Acquisition, LLC, Flanders, NJ (US)**(\*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.(21) **Appl. No.:** **13/374,942**(22) **Filed:** **Jan. 24, 2012**(65) **Prior Publication Data**

US 2012/0151083 A1 Jun. 14, 2012

**Related U.S. Application Data**

(63) Continuation of application No. 12/800,152, filed on May 10, 2010, now Pat. No. 8,122,141, which is a continuation of application No. 10/893,814, filed on Jul. 19, 2004, now Pat. No. 7,716,358, which is a continuation-in-part of application No. 09/819,337, filed on Mar. 28, 2001, now Pat. No. 6,766,376.

(60) Provisional application No. 60/231,997, filed on Sep. 12, 2000.

(51) **Int. Cl.**  
**G06F 15/16** (2006.01)(52) **U.S. Cl.** ..... **709/231**(58) **Field of Classification Search** ..... **709/230**  
..... **709/231**

See application file for complete search history.

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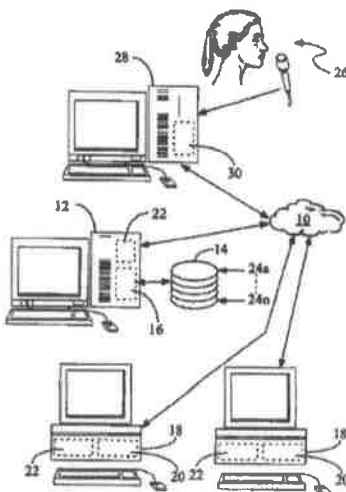
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**Primary Examiner** — Larry Donaghue**Assistant Examiner** — Marshall McLeod(74) **Attorney, Agent, or Firm** — Ernest D. Buff; Ernest D. Buff Assoc. LLC(57) **ABSTRACT**

Streaming media, such as audio or video files, is sent via the Internet. The media are immediately played on a user's computer. Audio/video data is transmitted from the server more rapidly than it is played out by the user system. The audio/video data in the user buffer accumulates; and interruptions in playback as well as temporary modem delays are avoided.

**4 Claims, 3 Drawing Sheets**

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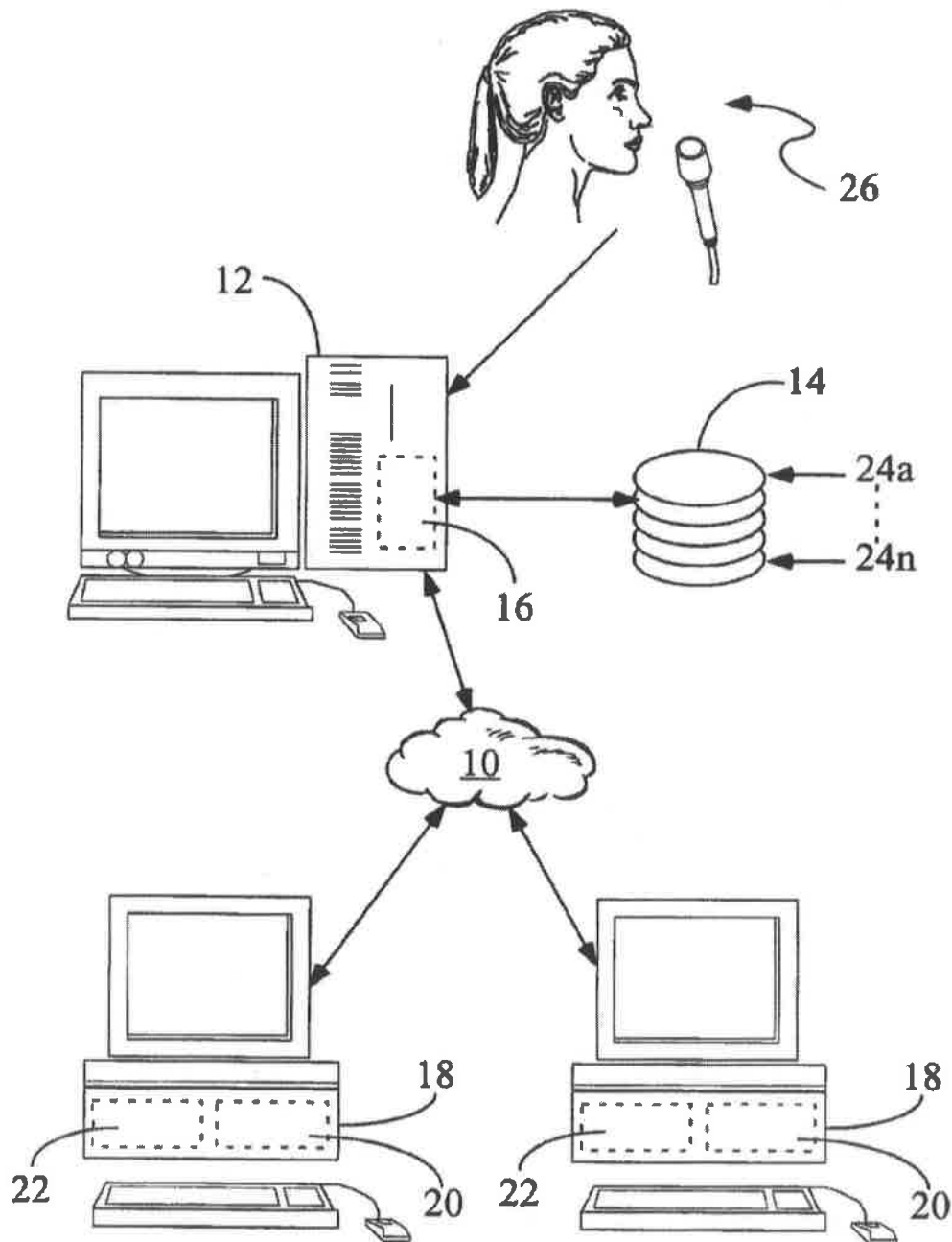
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Fig. 1



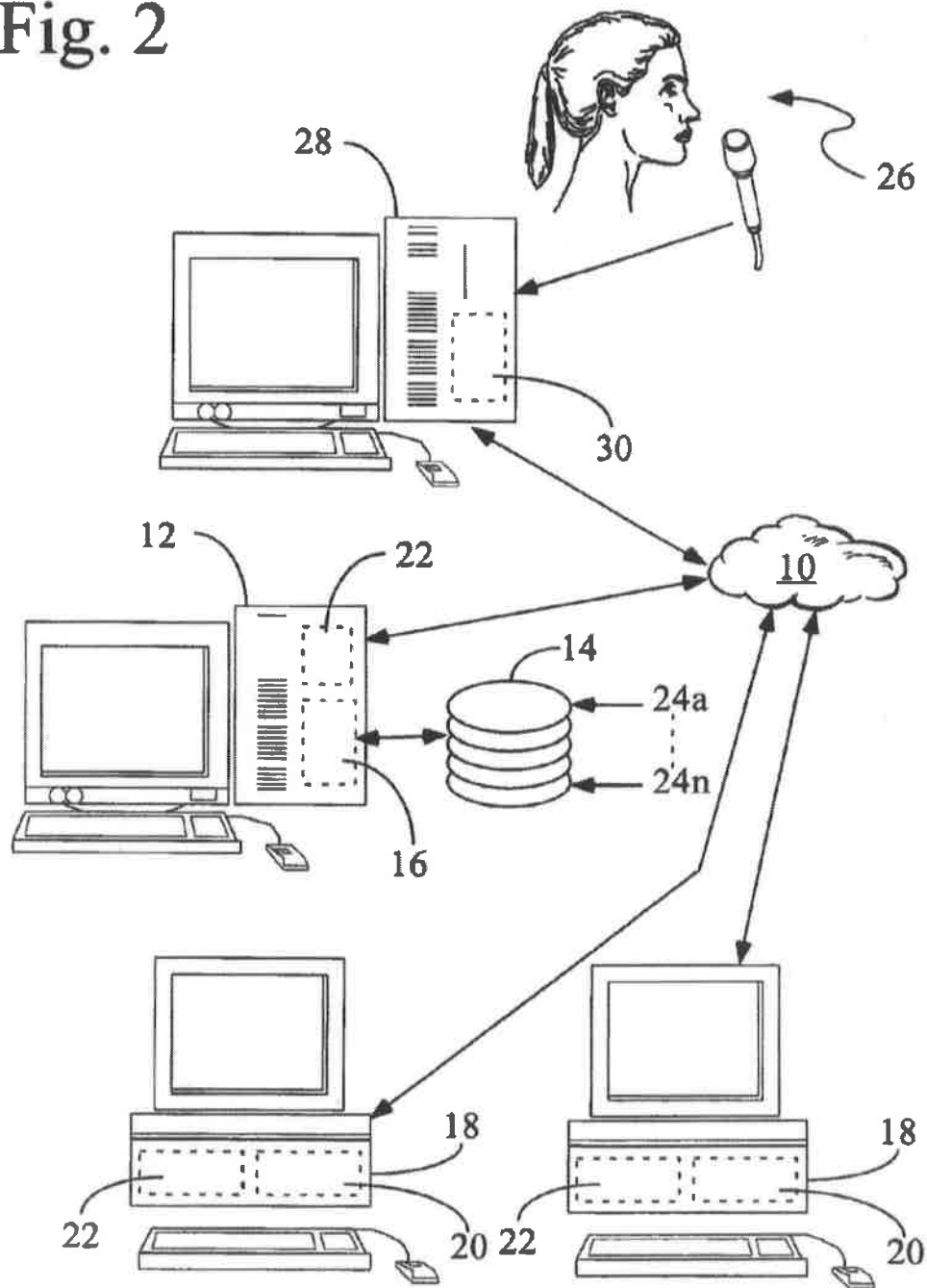
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Fig. 2



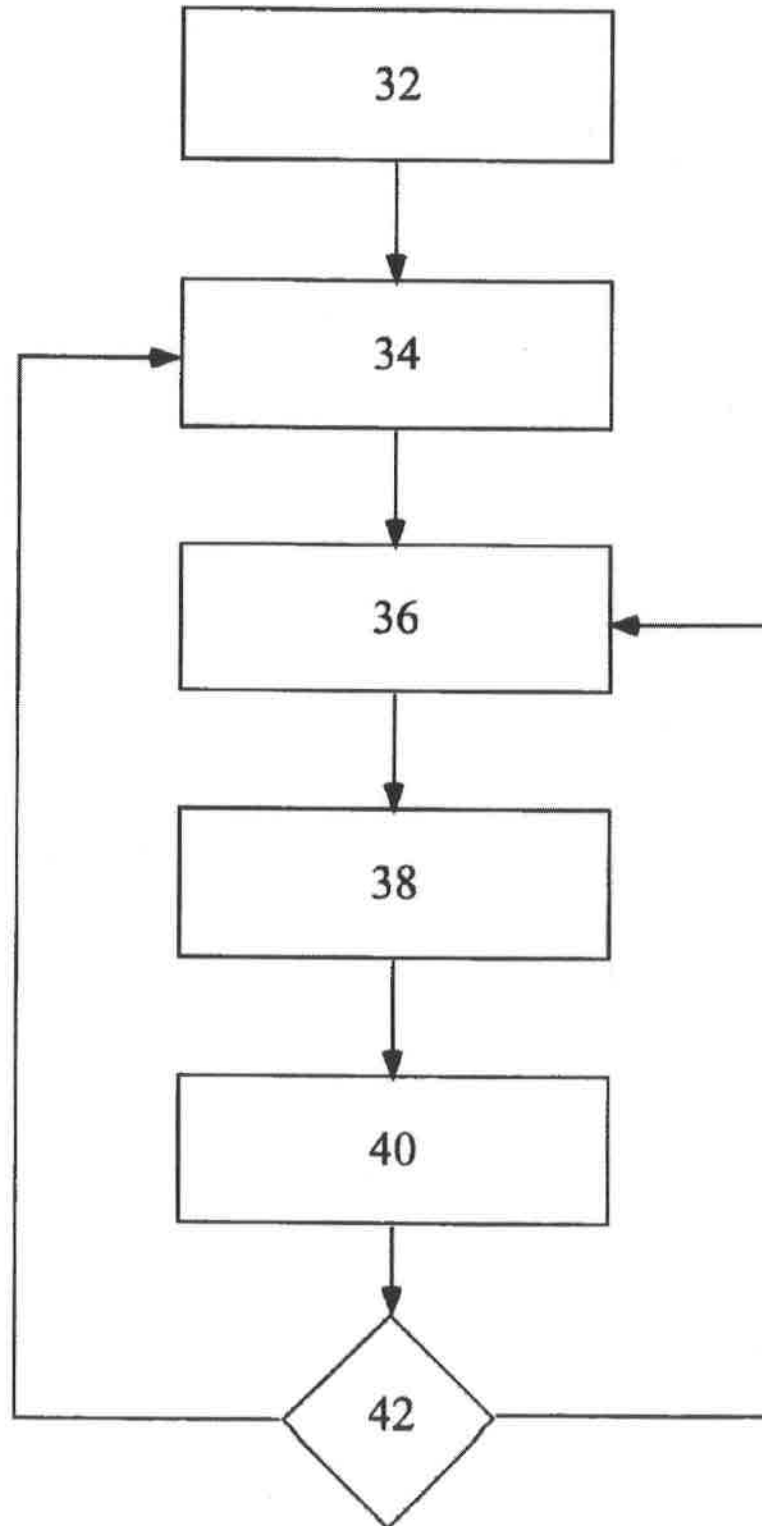
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**Fig. 3**



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## STREAMING MEDIA BUFFERING SYSTEM

### CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 12/800,152, filed May 10, 2010 (published on Sep. 16, 2010 as U.S. patent publication number 2010/0235536 A1, and now U.S. Pat. No. 8,122,141), which was a continuation of U.S. patent application Ser. No. 10/893,814, filed Jul. 19, 2004 (published on Dec. 9, 2004 as U.S. patent publication number 2004/0249969 A1, and now U.S. Pat. No. 7,716,358), which was a continuation-in-part of U.S. patent application Ser. No. 09/819,337, filed Mar. 28, 2001 (now U.S. Pat. No. 6,766,376), which claimed the benefit under 35 U.S.C. §119(e) of U.S. provisional patent application Ser. No. 60/231,997, filed Sep. 12, 2000; and it claims the benefit, under 35 U.S.C. §120, of the respective filing dates of each of said applications, as well as benefit of the respective filing dates of U.S. patent application Ser. No. 12/800,177, filed May 10, 2010 (published on Sep. 2, 2010 as U.S. patent publication number 2010/0223362 A1, and now U.S. Pat. No. 8,185,611) which was also a continuation of said U.S. patent application Ser. No. 10/893,814, and of copending U.S. patent application Ser. No. 10/825,869, filed Apr. 16, 2004 (published on Dec. 23, 2004 as U.S. patent publication number 2004/260828 A1), which was a continuation of said U.S. patent application Ser. No. 09/819,337; and hereby incorporates by reference the entire disclosure of each of said prior applications.

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

The present invention relates to multimedia computer communication systems; and more particularly, to a buffering system for streaming media, such as audio/video, on the Internet.

#### 2. Description of the Related Art

Prior to the development of Internet streaming media technologies, audio and video were formatted into files, which users needed to download to their computer before the files could be heard or viewed. Real time, continuous media, as from a radio station, was not suitable for this arrangement in that a file of finite size must be created so it could be downloaded. The advent of streaming media technologies allowed users to listen or view the files as they were being downloaded, and allowed users to "tune-in" to a continuous media broadcast, or "stream", such as from a radio station.

Since audio and video media must play out over a period of time it is more appropriate to think of bandwidth requirements than file size. The bandwidth requirement of an audio or video media refers to the data rate in bits per second that must be transmitted and received in order to listen or view the material uninterrupted. Transmitting the audio or video material over a connection slower than the bandwidth requirement results in unsatisfactory viewing or listening, if viewing or listening is possible at all. The connection available to most Internet users is by dial-up modem, which has a maximum receive data rate of 56,000 bits per second. Most audio and video available on the Internet has been compressed to be listenable or viewable within the 56,000 bits per second modem bandwidth. Requirements for achieving adequate audio and video over the Internet generally consume a considerable portion of the listener's available bandwidth.

Internet connection quality can vary rapidly over time, with two primary factors responsible for degradation of the instan-

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taneous bandwidth actually available to the user. These factors are the quality of the user's modem connection over telephone lines, which can have periods of interference causing reduced available bandwidth, and momentary Internet congestion at various points along the route over which the user's data flows. Each of these factors can cause delays and interruptions in the transmission of data to the user. Internet data communications devices such as routers are designed to drop data "packets" if they get overloaded. For material that is not time sensitive, these dropped packets will usually be resent, and the user will eventually be presented with the material. However, since streaming media is time sensitive, dropped packets can have a significant impact on the receipt and playback of an audio or video stream. These degradations in the receipt of Internet data are very common, and prevent most users from being able to listen to or view streaming media without interruption unless some special provisions have been incorporated into the user's computer software to accommodate data transmission interruptions.

These interruptions are commonly referred to as "drop-outs", meaning that the data flow to the user has been interrupted (i.e., the audio "drops out"). Dropouts can be extremely annoying—for example, while listening to music. The current state-of-the-art solution to the problem uses a pre-buffering technique to store up enough audio or video data in the user's computer so that it can play the audio or video with a minimum of dropouts. This process requires the user to wait until enough of the media file is buffered in memory before listening or viewing can begin. The media data is delivered by a server computer which has available to it the source of the media data, such as by a connection to a radio station. When the user connects to the server via the Internet, audio/video output at the user's system is delayed while the user's buffer is filled to a predetermined level. Typical pre-buffering wait times range from 10 to 20 seconds or more, determined by the vendor providing the audio or video media. Even with this pre-buffering process, interruptions in playback still occur.

In this process, the user has a software application on the computer commonly called a "media player". Using the features built into the media player, the user starts the audio or video stream, typically by clicking on a "start" button, and waits 10-20 seconds or so before the material starts playing. During this time data is being received from the source and filling the media player's buffer. The audio or video data is delivered from the source at the rate it is to be played out. If, for example, the user is listening to an audio stream encoded to be played-out at 24,000 bits per second, the source sends the audio data at the rate of 24,000 bits per second. Provided that the user waits 10 seconds, and the receipt of the buffering data has not been interrupted, there is enough media data stored in the buffer to play for 10 seconds.

Gaps in the receipt of audio/video data, due to Internet slowdowns, cause the buffer to deplete. Because transmission of audio/video media data to the user takes place at the rate it is played out, the user's buffer level can never be increased or replenished while it is playing. Thus, gaps in the receipt of audio/video media data inexorably cause the buffer level to decrease from its initial level. In time, extended or repeated occurrences of these gaps empty the user's buffer. The audio/video material stops playing, and the buffer must be refilled to its original predetermined level before playing of the media resumes.

By way of illustration in a 10 second pre-buffering scenario, if the data reception stopped the instant that the media started playing, it would play for exactly 10 seconds. Once it starts playing, the media data plays out of the buffer as new



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media data replenishes the buffer. The incoming data rate equals the rate at which the data is played out of the user's buffer, assuming the receipt of data across the Internet is unimpeded. If there are no interruptions in the receipt of the media data for the duration of the time the user listens to or watches the material, the buffer level remains constant and there will still be 10 seconds of data stored in the media player's buffer when the user stops the player. On the other hand, if the media player encounters interruptions totaling 6 seconds while playing the material, there would only be 4 seconds of media data remaining in the buffer when the user stopped it. If data reception interruptions at any time during the playing exceed 10 seconds, the user's media player buffer becomes exhausted. There is no media data to play, and the audio or video stops—a dropout has occurred. At this point a software mechanism in the media player stops attempting to play any more of the material, and starts the buffering process again. The media player remains silent until the buffer refills, at which time the media player will once again start playing the material.

There are two fundamental types of streaming media: (i) material that originates from a source having a real-time nature, such as a radio or TV broadcast, and (ii) material that originates from a non-real-time source such as from a disk file. An example of non-real-time material might be a piece of music stored as a disk file, or a portion of a broadcast that originally was real-time, perhaps yesterday's TV evening news, and was recorded into a disk file. For purposes of clarity within this document, streaming media of type (i) will be referred to as "broadcast" media, and streaming media of type (ii) will be referred to as "file based" media.

Both streaming media types are handled similarly in conventional systems, and both are handled similarly by the streaming media buffering system of the present invention. The two streaming media types are readily distinguished. Broadcast streaming media has as its source a system or arrangement that by definition can only be transmitted to users as fast as the material is generated; for example, a disk jockey speaking into a microphone. File based media, on the other hand, can be transmitted to users at any data rate, since there is no inherent time element to a file residing on a computer disk. With conventional Internet streaming media systems for streaming media of either type, media data is transmitted from the server to the user at the rate at which it will be played out, regardless of the data rate capabilities of the connection between the server and the user.

Conventional streaming media systems may incorporate buffering systems for programmatic purposes. For example, the system may buffer media data at the server for the purpose of packet assembly/disassembly. Media data may also be buffered at the server to permit programming conveniences such as dealing with chunks of data of a specific size. Such server buffering of media data is not used by conventional streaming media systems to mitigate long term Internet performance degradation as described hereinafter.

The sending of audio or video files via a network is known in the art. U.S. Pat. No. 6,029,194 to Tilt describes a media server for the distribution of audio/video over networks, in which retrieved media frames are transferred to a FIFO buffer. A clock rate for a local clock is adjusted according to the fullness of the buffer. The media frames from the buffer are sent in the form of data packets over the networks in response to interrupts generated by the local clock. In this manner, the timing for the media frames is controlled by the user to assure a continuous stream of video during editing. U.S. Pat. No. 6,014,706 to Cannon, et al. discloses an apparatus and method for displaying streamed digital video data

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on a client computer. The client computer is configured to receive the streamed digital video data from a server computer via a computer network. The streamed digital video data is transmitted from the server computer to the client computer as a stream of video frames. U.S. Pat. No. 6,002,720, to Yurt, et al. discloses a system of distributing video and/or audio information wherein digital signal processing is employed to achieve high rates of data compression. U.S. Pat. No. 5,923,655, to Veschi et al. discloses a system and method for communicating audio/video data in a packet-based computer network wherein transmission of data packets through the computer network requires variable periods of transmission time. U.S. Pat. No. 5,922,048 to Emura discloses a video server apparatus having a stream control section which determines a keyframe readout interval and a keyframe playback interval that satisfy a playback speed designated by a terminal apparatus. Finally, U.S. Pat. No. 6,014,694 to Aharoni, et al. discloses a system and method for adaptively transporting video over networks, including the Internet, wherein the available bandwidth varies with time.

There remains a need in the art for a method and system that afford immediate and uninterrupted listening/viewing of streaming media by the user.

#### SUMMARY OF THE INVENTION

The present invention provides a system and method for sending streaming media, such as audio or video files, via the Internet. Immediate playing of the media on a user's computer is afforded while reducing interruptions in playback due to Internet congestion and temporary modem delays due to noisy lines. Nearly instantaneous playback is achieved, while maintaining protection against playback interruption. Delayed starts, heretofore required to provide protection against interruption, are avoided. Data loss due to interruptions in the receipt of media data by the media player can be recovered while the player continues to play out the audio or video material. If the interruptions are so severe as to deplete the user's buffer and stop the play out, the media player will begin to play out again as soon as the media player begins to receive media data without waiting to first build up the buffer.

Generally stated, the invention provides a system for distributing via the Internet streaming media composed of a plurality of time-sequenced data elements. The system has a server connected to the Internet for transmitting the data elements. Associated with the server are a buffer manager and a FIFO buffer for storing at least one of the data elements for transmission. The buffer manager comprises means for: receiving the media data; supplying media data in order to the FIFO buffer; supplying the FIFO buffer with a predetermined number of data elements; maintaining a pointer into the buffer for each user computer indicating the last media data element that has been sent to that user, thus indicating the next element or elements to be sent; and, once the FIFO buffer is full, deleting the oldest data elements in the buffer as new data elements are received, said means arranged to maintain the pre-determined number of data elements in the FIFO buffer. At least one user computer is connected to the server via the Internet or other data communications medium.

This invention presumes the existence of a data communications transport mechanism, such as the TCP protocol, for the reliable delivery of data in an ordered sequence from the source of the media data to the server, or from the server to the media player software of the user computer. Thus, the delivery of data in the proper sequence is outside the scope of this invention.

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The user computer is associated with a media player software incorporating a user buffer and comprises means for receiving and storing a predetermined number of media data elements which are received sequentially by the media player, playing the data out sequentially as audio and/or video, and deleting media data elements from the buffer as they are played out. As data is played out, the next sequential data elements are received from the server in such a fashion as to approximately maintain the predetermined number of data elements in the user's buffer.

There are two types of encoding schemes used for audio and video material—"Variable Bit Rate"—VBR, and "Constant Bit Rate"—CBR. CBR encoding represents the encoded media with a constant bit rate per second, regardless of the complexity of the material being encoded, for example, if an audio source is encoded at 20 kilobits per second at a Constant Bit Rate, the media data being produced from the encoding is at 20 kilobits per second whether the audio material is symphonic music or silence. Variable Bit Rate encoding uses a variable number of bits to represent sounds, with more bits required for complex (symphonic) sounds than for simple sounds or silence. The standard encoding scheme used for streaming media is CBR because the resulting data rate is more predictable than for VBR.

The server stores a predetermined amount of media data in a First-In First-Out (FIFO) buffer in an arrangement that receives media data directly or indirectly from a real-time source, such as a radio station. For example, the server buffer might be set to store up 30 seconds of media data. Because the source produces media data in real time, the media data is delivered to the server approximately at the rate it is generated. Of course there can be variability's in this data delivery process due to networking, disk accesses, and so on, causing the delivery rate of the media data to be variable over short periods of time, typically measured in seconds. But over a longer period of time measured in minutes or tens of minutes or longer, the media data is delivered from source to server at the rate it is generated, and the server in turn provides that media data to the FIFO buffer at that same rate. Since CBR encoding is normally used for streaming media, the media data is generated, received by the server, and provided to the buffer approximately at a fixed rate. Once the buffer is full, for each new data element received into the buffer the oldest data element is deleted from the buffer. Once a connection is made to a user's computer, the server sends the media data to the user computer's buffer in the following manner. First, media data is sent to the user at the highest rate that the data connection between the server and the user computer will support until the predetermined amount of data that had been stored in the server buffer has been transferred to the user's computer. Once the buffer has been transferred a steady state condition is reached wherein as each media data element arrives at the server, it is immediately sent out to the user computer. In this steady state condition, the media data is sent at a rate that matches the fill rate of the server buffer, and is received at the same rate by the user computer if there are no interruptions in the transmission of media data between the server and the user's computer. If interruptions have interfered with the arrival of sent media data to the user's computer, that data may have been "dropped" by routers in the Internet and needs to be resent. This causes data to "back up" into the server FIFO for that user.

In one method of operation, the resending of missing data is the responsibility of a reliable transport mechanism, such as TCP. The server buffer "sends" data by delivering it to the transport mechanism. The transport mechanism actually "sends" the data across the communications medium, and has

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processes which determine if all the data that has been sent has been received by the destination. If not, missing pieces of data are automatically resent to the destination, and are arranged to be delivered to the target software on the destination system in an ordered fashion. In the circumstance of this invention, the destination is the user computer, and the target software on the destination system is the media player. If the transport mechanism determines that data is missing, it retransmits that data to the destination as fast as the connection between the server and destination will allow. The net effect of this invention is that all media data to be delivered to a user computer is always sent as fast as the communications medium will support, either by the server buffer passing media data to the transport mechanism, or by the transport mechanism delivering or redelivering the media data to the user computer. This is enabled by buffering data at the server, and is distinctly different from prior art in which media data is only sent from the server to the user computer at the rate at which it is to be played out.

In another method of operation, the server can use an unreliable transport mechanism, such as UDP, and rely on a streaming software process to manage data delivery and the resending of data elements not received by the media player.

As an example of the preceding description, if the server had been set to store 30 seconds of audio in its buffer, when a user connects that 30 seconds worth of media, data is transferred to the user's media player buffer as fast as the data connection between the two will allow. The media player can begin playing as soon as it has received a very minimum amount of data, perhaps comprising only a single packet of media data. For ease of understanding, consider the server buffer and the media player buffer to be an elastic system that between the two stores up 30 seconds of audio data. The server starts with 30 seconds of buffered audio data which it transfers to the media player until the server has no buffered media data and the media player has 30 seconds of buffered media data. Regardless of how much of the buffered media data has been transmitted to the media player, there always is 30 seconds of media data being buffered between the two locations. Consequently, the audio being played out by the media player will always be 30 seconds behind the audio at the source. If there were a media player in the radio station studio, an announcer would hear themselves through the media player with a 30 second delay.

Routinely, once a steady state has been achieved, the next data element to be sent is the next sequential data element from that which has already been received by the user's computer buffer. However, if there is more data to be sent than at the routine constant fill rate, such as in the condition where some media data has been resent by the reliable transport layer, the server transport mechanism will again send the buffered media data as fast as the connection between the server and the user's computer will support. Similarly, if the media player buffer begins to deplete or becomes depleted due to networking interruptions, the server will attempt to send as much data as is necessary to rebuild the user computer's buffer to the proper level. This allows for rebuilding the user's computer buffer under circumstances wherein Internet interruptions have blocked the normal flow of data. When compared to conventional systems, which provide no capability to rebuild the user's computer buffer when data is lost, the streaming media buffering system of the present invention provides for recovery of lost data elements and the restoration of the user's buffer, even while the user media player continues to play.

Under conditions in which interruptions have interfered with the arrival of sent media data to the user's computer, data



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loss exceeding certain levels will cause the transport mechanism software to stop accepting data for transmission from the application software, namely the streaming media server software. Although other arrangements are possible within the scope of this invention, in the preferred embodiment, the streaming media server software keeps track of the last data element in the FIFO buffer that has been "sent" to each user using a software pointer. An interruption in the ability to send media data to a user results in this pointer "backing Up" in the FIFO in such a way that the server knows from what point in the buffer to restart sending data when the transport mechanism again requests data to send. When the server software receives that notification, it will begin sending data to the user starting from the next data element to send as indicated by the pointer, and sending as much data as the transport mechanism will accept. The transport mechanism will again send this data as fast as it can to the user. This process continues until the steady state condition is again reached wherein each data element is sent to the user as soon as it arrives from the media source.

In another embodiment, the server is connected to the Internet, and to a broadcast media source, such as a radio station. A radio station computer is provided with a means for receiving media data elements as they are generated by the audio and/or video source, and for transmitting those media data elements to the server as they are generated. As before, the server provides a buffer manager and a FIFO buffer, and provides a means for receiving the sequentially arranged media data elements from the broadcast media source and storing those data elements in the FIFO buffer. The buffer manager comprises means for: supplying the FIFO buffer with a predetermined number of data elements; maintaining a pointer into the buffer for each user computer indicating the last media data element that has been sent to that user, thus indicating the next element or elements to be sent; and, once the FIFO buffer is full, deleting the oldest data element in the buffer as each new data element is received. Importantly, the buffer manager is arranged to maintain the pre-determined number of data elements in the FIFO buffer. At least one user computer is connected to the server via the Internet or other data communications medium.

The user computer is associated with a media player software incorporating a user buffer and comprises means for receiving and storing a predetermined number of media data elements, playing the data out sequentially as audio and/or video, and deleting media data elements from the buffer as they are played out. As data is played out, the next sequential data elements are received from the server in such a fashion as to approximately maintain the predetermined number of data elements in the user's buffer. It should be understood that data might arrive at the media player out-of-sequence and that processes in the media player or the media player buffer manager are responsible for properly arranging this data.

In another embodiment, the server is connected to the Internet and provisioned as initially described, and has available to it file based media data as the source material. The file based media data can be read by the server which can deliver media data elements to the server FIFO buffer at a constant time-sequenced rate, as if the data were arriving from a broadcast media source. As before, the server provides a buffer manager and a FIFO buffer, and provides a means for receiving the sequentially arranged media data elements from the file based media source and storing those data elements in the FIFO buffer. The buffer manager comprises means for: receiving the media data; supplying media data in order to the FIFO buffer; supplying the FIFO buffer with a predetermined number of data elements at a constant time-sequenced fill

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rate; maintaining a pointer into the buffer for each user computer indicating the last media data element that has been sent to that user, thus indicating the next element or elements to be sent; and, once the FIFO buffer is full, deleting the oldest data element in the buffer as each new data element is received, said means arranged to maintain the pre-determined number of data elements in the FIFO buffer. The server buffer manager, or a separate process on the server, or a process on another computer having access to the file based media data, provides for reading the media data file and making available to the FIFO buffer sequentially arranged media data elements. At least one user computer is connected to the server via the Internet.

The user computer is associated with a media player software incorporating a user buffer and comprises means for receiving and storing a predetermined number of media data elements, which are received sequentially by the media player, playing the data out sequentially as audio and/or video, and deleting media data elements from the buffer as they are played out. As data is played out, the next sequential data elements are received from the server in such a fashion as to approximately maintain the predetermined number of data elements in the user's buffer.

In another embodiment, the server is connected to the Internet and provisioned as initially described. The server buffer manager, or the media source, provides for sequentially numbering the media data elements. The server buffer manager does not maintain a pointer into the server buffer for each user. Instead, the media player buffer manager in the user computer maintains a record of the serial number of the last data element that has been received. Via the use of standard data communications protocol techniques such as TCP, the user computer transmits a request to the server to send one or more data elements, specifying the serial numbers of the data elements. The server responds by sending the requested data elements, and depends upon the reliable transmission protocol to assure delivery. The user computer then continues with additional data requests for the duration of playing the audio/video material. In this manner, the user computer, not the server, maintains the record of the highest data element number stored in the user computer buffer. The media data will be transmitted to the user computer as fast as the data connection between the user computer and the server will allow. As before, the server provides a buffer manager and a FIFO buffer, and provides a means for receiving the sequential media data elements from a broadcast media source or a file based media source, and storing those data elements in the FIFO buffer. The buffer manager comprises means for: receiving the media data; supplying media data in order to the FIFO buffer; supplying the FIFO buffer with a predetermined number of data elements; and, once the FIFO buffer is full, deleting the oldest data element in the buffer as each new data element is received. Such means is arranged to maintain the pre-determined number of data elements in the FIFO buffer. At least one user computer is connected to the server via the Internet.

The user computer is associated with a media player software incorporating a user buffer and comprises means for receiving and storing a predetermined number of media data elements, playing the data out sequentially as audio and/or video, and deleting media data elements from the buffer as they are played out. As data is played out, the next sequential data elements are requested from the server in such a fashion as to approximately maintain the predetermined number of data elements in the user's buffer. It should be understood that data might arrive at the media player out-of-sequence and that



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processes in the media player or the media player buffer manager are responsible for properly arranging this data.

In yet another embodiment, the invention provides a method for distributing from a server via the Internet streaming media composed of a plurality of time-sequenced data elements. A predetermined number of the data elements are sequentially loaded into a FIFO buffer. Additional data elements continue to be received. As each new data element is input to the buffer, the oldest data element is deleted from the buffer, maintaining in the buffer the same predetermined number of data elements. At the request of a user computer for connection to a media stream, a group of the data elements is sequentially sent via the Internet from the FIFO buffer to the user computer connected to the Internet. Upon being received by the user computer, the sent group of data elements is loaded into a user's buffer associated with the user computer. The user's computer immediately begins to play the audio/video streaming media material. The server continues to send the next data elements in sequence until the contents of the FIFO buffer have been sent. The data elements are sent by the server as fast as the connection between the server and user computer will allow. Once the contents of the FIFO buffer have been sent to a user computer, as each new data element is received into the FIFO buffer it is immediately sent to the user computer in such a manner as to keep the user computer buffer full. The process repeats for substantially the entire time that the audio/video material is played.

Unlike conventional buffering systems, audio begins to play on the user system as soon as the user connection to the audio server is effected and a small amount of data has been transferred. Conventional systems required many seconds of data. Audio/video media data is initially transmitted from the server more rapidly than it is played out by the user system, until the server buffer has been transferred to the user computer. The user's buffer is built up while the audio is playing, and can be restored if it is diminished by data transmission interruptions. Advantageously, the system and method of this invention afford faster data transmissions than the playback data rate of the media data. Audio/video data is transmitted from the server more rapidly than it is played out by the user system under conditions wherein the user's computer buffer is not full. The audio/video data in the user buffer accumulates; interruptions in playback due to temporary Internet and modem delays are avoided. It should be realized that, although the invention has been described hereinabove in connection with a process wherein the server sends buffered media data to the user "as fast as the network connection will permit", it is adequate, as mentioned in this paragraph, that the buffered data be transferred from the server to the user at a rate faster than the playback rate.

Although the preferred embodiment utilizes a reliable transport mechanism to move data between the server and the user, alternative embodiments could incorporate this invention's buffering system in combination with an unreliable datagram-based transport mechanism.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be more fully understood and further advantages will become apparent when reference is had to the following detailed description and the accompanying drawings, in which:

FIG. 1 is a schematic diagram illustrating the elements of a streaming media buffering system in accordance with the present invention;

FIG. 2 is a schematic diagram of an alternative embodiment of the system shown by FIG. 1; and

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FIG. 3 is a block diagram illustrating the method of the present invention.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention relates to a buffering system for streaming media, such as audio/video, on the Internet.

In one embodiment, the invention provides a system for distributing via the Internet streaming media composed of a plurality of time-sequenced data elements. As shown in FIG. 1, the system is provided with a server 12 connected to the Internet 10 for transmitting the streaming media data elements. Associated with the server 12 is a FIFO buffer 14 for storing at least one of the data elements for transmission, and a buffer manager 16. Buffer 14 is a conventional computer storage mechanism such as a hard disk, as shown for convenience of illustration, or, preferably, an electronic storage arrangement such as Random Access Memory (RAM). The buffer manager 16 is in the form of software or firmware that provides means for: receiving the media data; supplying media data in order to the FIFO buffer; supplying the buffer 14 with a predetermined number of data elements; maintaining a pointer 24a through 24n into the buffer, one for each user computer indicating the last media data element that has been sent to that user, thus indicating the next element or elements to be sent; and, once the FIFO buffer is full, deleting the oldest data element in the buffer as each new data element is received, said means arranged to maintain the pre-determined number of data elements in the FIFO buffer. Buffer Manager 16 may also comprise means for: formatting media data according to the requirements of buffer 14, and for digitizing, encoding, and packetizing the media data.

There is at least one user computer 18 connected to the server 12 via the Internet 10. A user buffer 20 is associated with the user computer 18. The user buffer 20 is provided with means for storing a predetermined number of the data elements. User buffer 20 is a conventional computer storage mechanism such as a hard disk, or, preferably, an electronic storage arrangement such as Random Access Memory (RAM) as suggested by the illustration. A buffer manager 22 is associated with the user computer 18. The buffer manager 22, having the form of software or firmware, is provided with means for receiving and storing a predetermined number of media data elements which are received by the media player, playing the data out sequentially as audio and/or video, and deleting media data elements from the buffer as they are played out.

The media may come from a live source, shown as 26 in FIG. 1, or from a stored file on the server 12, or another storage device, such as a hard drive. For broadcast media, as the term is used herein, such as an announcer speaking into a microphone, or playing a CD, the media source 26 can only transmit audio/video data as fast as it is generated. If the media source is file based, such as a music clip stored as a disk file, and if that disk file is stored on the server or an associated server computer, this connection could be considered to be near instantaneous. In this case, rather than audio/video data filling and depleting the buffer 14, an amount of audio/video data equivalent to the desired buffer size is logically constituted as a FIFO buffer. Such a construct is commonly called a data window. The data window moves on a time-sequenced basis through the media data file, thus defining the contents of the buffer on a moment-by-moment basis and performing the equivalent functions to receiving a new data element and deleting the oldest data element.

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The server 12 maintains a buffer of audio/video data comprising an amount adequate to bridge gaps typical of Internet and modem delays to the user. Preferably, this buffer holds enough data elements for about one minute of play. The server buffer 14 is filled the first time the media source connection is established or a disk file is read.

Connections from the server 12 through the Internet 10 commonly are much faster than the data rate required for audio or video playback. This fact is insignificant for conventional servers because, not having a FIFO buffer or a buffer pointer for each user, audio/video data can only be sent as fast as it becomes available, or as fast as the pace at which it must be delivered to the user in order to be properly replayed. The user, typically interacting with "media player" software on their computer, selects an audio source requiring a data rate slower than that available by the user's connection to the Internet. For example, if the user's connection to the Internet is made via a 56,000 bits per second modem, the user might select a media source encoded for playback at 24,000 bits per second.

With the present invention, as soon as a user connects to the server 12, the server 12 transmits audio/video data as sequential data elements from its buffer 14 to the buffer 20 of the user as fast as the data connection will allow. Unlike the prior art, media begins to play on the user computer 18 as soon as the user connection is made to the audio server 12 and a minimal amount of data elements have been received and stored in the user's buffer 20. The user's buffer 20 is built up while the media is playing. As each data element is played, it is deleted from the user's buffer 20. Initially, the user buffer manager 22 requests the server 12 to send media data elements to start the playback stream, such as by selecting a radio station from a list. The server 12 responds by sending data elements to the user computer 18 as fast as it can, until the entire FIFO buffer 14 has been sent to the user computer. Upon receipt of the initial data elements, the user buffer manager 22 begins playback. Because this is a synchronous system with the source, server, and user computer operating by the same playback clock rate as determined by the encoding rate of the media, as each data element is played out and is deleted from the user buffer 20, another data element has been deposited into the server buffer 14 and is available to be sent to the user computer. Server 12 sends the newly available data elements as fast as the data rate of the connection between server 12 and user computer 18 will allow.

Since the connection from the Internet to the user is faster than that required for media playback, audio/video data is transmitted from the server faster than it is played out by the user system, thus building up audio/video data in the user buffer. For example, if the user's connection to the Internet is at 56,000 bits per second, and the data rate encoded for the media to be played is 24,000 bits per second, the buffer level of the user buffer 20 will fill at the rate of 32,000 bits per second (56,000 bits per second receive rate, minus 24,000 bits per second playout depletion rate).

If, for example, the server buffer 14 held one minute of audio/video data, eventually the user buffer 20 will hold one minute of audio/video data. The effect is that, over a brief period of time, the server buffer 14, or a designated portion of it, is transferred to the user buffer 20. The number of data elements in the server buffer 14 actually never changes, it always maintains one minute of audio/video data. However, for the particular user under discussion, a copy of all the data held in the buffer has been sent to the user. Since the user buffer 20 now holds one minute of audio/video data, it can play continuously despite data reception interruptions of less than a minute, and as soon as the interruption ceases the user

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buffer 20 can begin to rebuild, which will take place as fast as the connection between the user computer 18 and the server 12 will allow. The media player can continue to play out the audio/video material while the user buffer 20 rebuilds.

The predetermined buffer level in the user buffer 20 may be set at less than the predetermined buffer level of the server buffer 14 if desired. For example, the server buffer 14 might be set to hold one minute of media data, and the user buffer 20 might be set to hold thirty seconds of media data.

Alternatively, the user computer is replaced by an Internet radio or Internet Appliance, which is comprised of a dedicated processor for receiving Internet radio or audio/video material. Examples of such devices might range from familiar computing devices such as palmtops, PDAs (Portable Digital Assistants), and wireless phones, to devices that appear and operate similarly to conventional consumer electronic devices such as radios and televisions, but with the additional capability of Internet access.

In another embodiment, as shown in FIG. 2, the media source may be remote from the server 12, such as a computer system 28 in a radio station studio. This computer includes a source manager 30 which may be implemented in software or firmware. The source manager 30 comprises means for: formatting media data according to the requirements of server 12, buffer 14, and buffer manager 16; and, for transmitting that media data to server 12. Source manager 30 may further include means for digitizing, encoding, and packetizing the media data. Media data typically is generated in real time such as by a speaker talking into a microphone or by playing a CD. Generally, computer system 28 transmits media data to server 12 in real time as the media data is generated. Buffering of media data might occur at computer system 28 for convenience of programming, but such buffering is incidental to the operation of the end-to-end system being described. Computer system 28 connects via the Internet 10, or other suitable data communications medium, to a server 12, wherein server buffer manager 16 receives the media data for input into the FIFO buffer 14 as described previously. Server 12, in turn, transmits the media data to one or more user computers 18, also as previously described. Network connections between the source computer and the server may cause media data to be delayed in arrival at the server, causing the server FIFO buffer occasionally to be less than full. In this circumstance, the server buffer transfers the media data that it has available in its buffer to the media player, and when more data arrives from the source, the server sends it out to the media player.

In another embodiment, shown in FIG. 3, the invention provides a method for distributing from a server via the Internet streaming media composed of a plurality of time-sequenced data elements. Time-sequenced data elements are generated or received 32. Next, a predetermined number of the data elements are sequentially loaded 34 into a server buffer, which process of 32 and 34 continues indefinitely as long as there is media data available. Next, a group of the data elements is sequentially sent 36 via the Internet from the server buffer to a user computer connected to the Internet. Upon receipt by the user computer, the sent group of data elements is loaded 38 into a user buffer associated with the user computer. The user computer immediately plays 40 the received portion of the media on the user computer. At 42, if the user buffer is not full, then additional data elements are sent to the user computer 36. And also at 42, if the user buffer is full, the system waits until new media data is delivered to the server buffer 34. This process is repeated until the entire media file is played at the user computer.

Unlike conventional buffer arrangements, audio begins to play on the user system as soon as the user connection is made

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to the audio server. The user's buffer is built up while the audio is playing. Advantageously, the system and method of this invention create a faster than real time connection. That is to say, audio/video data is transmitted from the server faster than it is played out by the user system, thus building up audio/video data in the user buffer. 5

Having thus described the invention in rather full detail, it will be understood that such detail need not be strictly adhered to, but that additional changes and modifications may suggest themselves to one skilled in the art, all falling within the scope of the invention as defined by the subjoined claims. 10

I claim:

1. A media player for receiving an audio or video program, the program comprising media data elements, from a media source over an Internet protocol network, and playing the program for a user of the media player, wherein each of the media data elements is associated with a serial number, comprising 15

a processor;

a memory;

a connection to the network; and

media player software comprising

instructions to cause the media player to request from the media source a predetermined number of media data elements;

instructions to cause the media player to receive media data elements sent to the media player by the media source and store the media data elements in the memory;

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instructions to implement a player buffer manager, for managing a player buffer established in the memory, operable to maintain a record of the serial number of the last media data element that has been received and stored in the player buffer;

instructions to cause the media player to play media data elements sequentially from the player buffer; and

instructions to cause the media player to transmit to the media source a request to send one or more media data elements, each identified by a serial number, and to repeat transmitting the requests to the media source for sequential media data elements so as to maintain the pre-determined number of media data elements in the player buffer until the last media data element comprising the program has been received.

2. A computer adapted to function as a media player in accordance with claim 1.

3. A wireless phone adapted to function as a media player in accordance with claim 1.

4. The media player of claim 1, wherein the instructions for causing the media player to request from the media source a predetermined number of media data elements further causes the media player to receive the predetermined number of media data elements at a rate more rapid than the rate at which the media data elements are to be played out by the media player. 25

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